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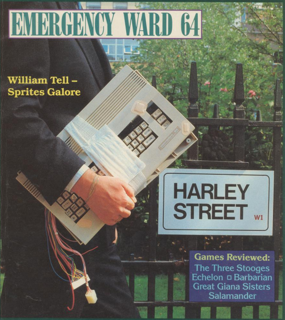

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ABC

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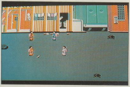

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VOLUME 5
NUMBER 2

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PRESS
GROUP

NOV ISSUE
AVAILABLE
7th OCTOBER
1988

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DATA STATEMENTS

FAST Broadside

A simulataneous swoop on software pirates in the Glasgow, Wishaw, and East Kilbride areas north of the border has netted the Federation Against Software Theft its most successful sortie yet. Assisted by the E Division of Glasgow CID and a motley crew of software house representatives, Bob Hay of FAST is now in possession of suspect software with a street value estimated at £100,000.

Of the co-ordinated raids, Bob said, "Piracy in Scotland has been of concern for some time but with some very good information and assistance from Electronic Arts, the Strathclyde police carried through a very thorough investiagation. Results so far are most encouraging."

Simon Jeffery, UK Sales Administration Manager for Electronic Arts and EA's representative on the raids added, "We are alerted to the pirates' activity both by end-users and our local dealer/salesman relationship, and worked closely with FAST over a number of months to make this operation a success. Electronic Arts feels that if software houses can work with FAST in talking a firm stand against piracy, it can be countered."

If you buy software and you think that it isn't the real McCoy, you should first of all contact the software house who normally markets. If you don't know the software house then you can contact Bob Hay on 01-430 2408.

New labels

Top selling budget software house, Alternative, have created a new lable, Again Again, which will be releasing full price games in time for Christmas. The first title, The Munsters, should be appearing later this month and involves the whacky exploits of Channel 4's cult television family of Frankenstein's, vampires and werewolves.

Psygnosis, originator's of Barbarian, have launched Psyclapse as a new games label. Once more, illustrator Roger Dean has been called in to design the new logo but future illustrations for the games will draw upon a broad spectrum of leading artists. Although Psyclapse will run alongside Psygnosis, the two labels are to maintain separate identities.

Touchline: *Again Again Units 3-6, Baileygate Industrial Estate, Pontefract, West Yorks WF8 2LN.*
Psyclapse First Floor, Port of Liverpool Building, Pier Head, Liverpool L3 2BY.

Free Disks

Compumart are suppliers of disk boxes for 3.5 and 5.25 inch disks. Amiga owners, or owners of the new 1581 drive for Commodore's eight bit machines, will be pleased to note that the 3.5 disk box has a special offer at the moment. With each box sold, Compumart will supply two free disks which amounts to almost a 50% reduction in the £11.26 cost of the box (excluding VAT but including first class delivery and same day despatch).

The storage boxes are lockable and made from anti-static, impact resistant plastic. Each 3.5 box can hold up to 70 disks and comes with a set of dividers.

Touchline: *Compumart, Jubilee Drive, Loughborough, Leics LE11 OXS.* **TEL:** *(0509) 61044.*

Two Board Tales

While Domark are busy revamping Trivial Persuit, Grandslam are working on a new boardgame conversion.

Grandslam's game is Espionage which takes the players into the world of secret agents travelling the globe to unearth four microfilms which form the plans for the ultimate super weapon.

As the search goes on, the spies will occasionally meet and battle to the death and the first one home with all four films is the winner.

Domark appear to have decided to squeeze as much as they can from their Trivial Persuit licence. In the offing is a new concept for the background behind the question and answer game which is more suited to computer players.

The game is called Genus II — A New Beginning and involves the players in a race to reach the planet of Genus II. Each player has to win a place on their laser powered spacecraft by answering a Trivial Persuit question correctly. On the journey through space, the craft has to land at six planets or stars and collect a luxury household item from each before finally arriving at Genus II.

Another venture of Domark's is the computer version of the 1973 James Bond movie Live and let Die. Rumour has it that the original Domark authored game was not considered good enough but Elite had a speedboat game on the starting blocks which fitted the bill. The result is a shared game which will feature both companies logos.

Touchline: *Domark House, 22 Hartfield Rd, Wimbledon, London SW19 3TA.* **Tel:** *01-947 5622.*

Juicy Jargon

At the newsdesk we get inundated with press releases for all manner of machines and services, many of which invite us for a tea and sticky bun session at some plush venue. The latest 'ave-a-lunch features two choice examples that makes trainspotters reach for their tech-specs.

The first, from Peterborough Software and aimed at personnel managers, opens with 'Dear Human Resource Professional' (pass the bucket, I think I'm going to be...). Honestly, if our personnel manager heard anyone labelling her in such a way they'd get an instantaneous pugilistic parry in the vicinity of the auditory orifice!

The second even more lush example refers to the launch of the Miracom Courier HST Modem. In plain terms, this is the kind of gubbins used by systems operators on bulletin boards. According to the release this little wonder exhibits, 'effective speeds up to 17,000 bps, employing trellis-coded modulation, asymmetrical full duplex transmission, data compression, and MNP error-control." Just what we've all been waiting for.

Stop Press

Two problems beyond our control have altered the contents of the magazine as displayed on our cover.

We apologise for the non-appearance of the Three Stooges revue destined for this issue but the Post Office strike affected receipt of the text. Normal service will be resumed by the time the December issue hits the street and the Three Stooges will be there.

The second apology relates to the Giana Sisters review. Although some copies of the game have been circulated, Nintendo have slapped an injunction on Rainbow Arts for infringement of copyright. US Gold, who hold the British distribution rights, have had to withdraw the game from sale until the situation is resolved.

US Gold deeply regret having to make this move and hope that Nintendo and Rainbow Arts can reach a mutual agreement which will allow the game back into circulation.

Plus 4 Fontasy

York Electronic Research are set to launch a new software package for the Plus 4. Using their program it is possible to create a series of printer typefaces which will give documents that extra touch of class.

A release date and price have not yet been fixed but you can be sure that we'll be putting it through its paces in a future review as soon as the YER production line gets going.

Touchline:
York Electronic Research, The Fishergate Centre, 4 Fishergate, York YO1 4AB. **Tel:** *(0904) 610722*

Fortran for the C64

Although the Fortran programming language has been around for thirty years, it is still one of today's most widely used languages. In the US, Abacus have developed a stripped down version for the C64 which supports over 45 statements and functions so that users can get the feel of the language and examine the benefits through hands-on experience.

Fortran 64 includes a built-in editor, compiler and linker so that fast standalone programs can be produced, running even when Fortran 64 is not in residence.

At the moment, there are no plans to release the program in the UK but maybe in time a pioneering company such as Financial Systems Software will see fit to import a few copies.

Touchline:
Abacus, 5370 52nd Street SE, Grand Rapids, MI 49508.

Special Reserve

Half price software is on offer as the public relations company, Inter-Mediates, diversifies into the mail-order business.

The venture takes the form of a club called Special Reserve and the £4 per year membership entitles each member to three issues of the Special Reserve Buyer's Guide in addition to the updates on new releases that are sent with every order.

The club boasts a catalogue in which discounts can be greater than 50% before postage and packing is added.

Touchline:
Inter-Mediates, 2 South Block, The Maltings, Riverside Way, Sawbridgeworth, Herts. **Tel:** *(0279) 726585*

Dragon Simulator

We knew they could do it if they tried. Code Masters latest release is called Super Dragon Slayer. 'Wot, no simulator,' we all cry.

Perhaps this departure into pastures new is in response to the expansion of the programming team.

Tim Miller is the latest signing for Code Masters and the gang of four (David and Richard Darling, Mark Baldock and Mike Clark) is now a quintet. Tim has written Skate Crazy for Gremlin and ATV Simulator for guess who?

The new signing the launch of several 16-bit projects which should be ready for release in the not-to-distant future.

Touchline:
Code Masters, Lower Farm House, Stoneythorpe, Southam, Warks CV33 ODL. **Tel:** *(0926) 814132.*

Tim Miller flanked by Richard and David Darling.

COMMUNICATIONS CORNER

Compunet, the on-line commercial database for C64, Amiga and ST users, has followed Prestel/Micronet and MicroLink and revised its tariff structure. The price of a Gold subscription (a Gold sub is favoured by those who use the service on a regular basis) is now £19.50 a quarter, an increase of £4.50. However, Gold subscribers will get an additional 1000 page/days which brings the total to 2000.

An additional £10 per quarter entitled a user to upload programs to the system regardless of length. This has now been restricted to 45,000 page/days per quarter.

The unlimited off-peak connect charge is now £10, a rise of 22p. Finally, the standard connect charge has risen from 60p to 80p per hour.

The price increases will hit the regular user who uploads programs onto the system — and at 75 baud! The concession of an additional 1,000 page/days is fine for those who use the chat on-line facility, or have text based areas, but those who upload programs on a regular basis will be hurt the most.

Considering that Compunet's survival relies on its users' goodwill to supply a regular stream of text-based material and programs, it's somewhat surprising that the company did not come up with a better concession than the extra 1,000 page/days.

Shades of Gold

Shades, the popular multi-user adventure game is now available on Telecom Gold.

Shades first appeared as a value added service (VAS) on Micronet a couple of years ago. Since then, Telemap, which operates Micronet, has made Shades available to all Prestel users, and recently it has become the premier feature on Telemap's 0898 service FunTel.

Shades can be played on Telecom Gold by entering SHADES at the chevron prompt ' '. During peak hours Shades will be free, as the cost is absorbed in the peak-rate charge. During off-peak hours the cost is 4.5p per minute on top of the off-peak charge.

Your Commodore notes that playing Shades on system 72 (MicroLink) is cheaper than playing the game on any other system because MicroLink does not charge for data transfer to or from Telecom Gold, as is the case with other systems.

MicroLink users, who use the GW command which displays a list of databases that are available via gateway, will notice that Shades is not included (even though it is available). When asked about this omission Derek Meakin, MD for Database Publications which operates MicroLink, said; "We haven't decided what to do about Shades yet."

Execudroids take note

Two developments have occurred in the comms world that will be of interest to business users.

First, MicroLink subscribers who read the excellent Newsbytes columns now have the option of reading EXEC after entering the newsbytes area. EXEC stands for executive briefing and unlike the other columns that contain comprehensive reports, EXEC is geared towards the business user and offers concise information as well as a contact.

Secondly, Prestel users will soon be able to read InterBusiness which is aimed towards those who are running small businesses and the self employed.

According to Telemap's PR manager, David Rosenbaum, InterBusiness will be a totally separate product from Micronet.

Telesoftware Amiga!

Previously, all downloadable telesoftware provided by Micronet has been stored as pages on the Prstel database. this has changed and Micronet is now providing all its telesoftware via a gateway.

This means that instead of storing a program as encoded pages on Prestel, a link is provided to Micronet's own Amiga 2000 on which all the programs are stored.

At the time of writing, technical details of how the system works were not available but it's clear that the decision to store telesoftware on their own system is a wise one. Programs for the Amiga, PC and ST tend to be large, and take up numerous frames. These frames cost Micronet money for rent, storing the programs on their own computer will no doubt save money.

An interesting aspect is that all the software is to be free of charge. This is because it's not possible to implement a frame charge via a gateway. Just what will happen to third-party, chargeable telesoftware (as provided by Your Commodore for example) is not yet clear.

A chatline at last

Commodore users who subscribe to Micronet now have their very own Chatline called CBM RABBIT.

Most machines supported by Micronet have their own chatline on which users can talk (rabbit?) specifically about their own type of computer.

Currently, CBM RABBIT is rather under-used, and Andy Waller who runs the Soley CBM area on Micronet may decide to place the regular letters section within CBM RABBIT.

Wanna bet?

Computers and betting have been used together for years. The major betting houses were amongst the first corporate group to make use of computers for computing odds, displaying the SP on a race such like. Now Telecom Gold users who like to play the gee-gees can subscribe to a new service called Turfnet.

Turfnet is a tipster service which provides its subscribers with the very latest information on a race. Unlike conventional racing sheets, Turfnet is updated every morning and takes into account whether conditions. Detailed information on the days racing is provided together with tips on the best horses.

Aimed at the serious punter (the service costs £20 per month), a free trial offer is available to anyone who sends a request to 74:SDR004.

Prestel users need not feel left out either. For quite some time a number of information providers (IPs) have been supplying punters with tipster services.

For the casual punter daily tips on Viewtel 202 are provided, while B&RD supply a daily tip for 55p. The more serious punter can analyse the data for a specific race on the B&RD database for 38p per race. The services mentioned do not require any extra subscription, however, the serious punter can subscribe to B&RDs more professional service which is also on Prestel.

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Any minute now the deluge of Christmas offerings will burst onto the scene... but not yet!

FORT APACHE
Bad Guys Killed
Score
200
Bad Guys Left

Kane II

Games Update

With luck, this month should mark the end of the summer lull caused by software houses mainly concentrating on the games they are preparing for launch in the run up to Christmas. This annual dearth is particularly marked this year with the opening of the Olympic Games in Seoul adding to the mountain of games awaiting autumn release.

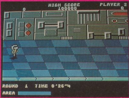
Traditionally, this makes early autumn a good time for compilations and budget games, particularly for the re-release of classics.

Budget games

There's a new force in cut-price software as US Gold back a new budget venture called Kixx. All Kixx games cost £2.99, with the initial batch of releases coming from US Gold's back catalogue which includes Ace of Aces, 10th Frame and this month's duo of Gauntlet and Metrocross.

Gauntlet is the arcade classic and features 512 levels of monsters, magic and treasure as you guide a wizard, warrior, elf or valkyrie into the depths of the dungeon. This was the Christmas number one two years ago and is still one of my favourite games.

Metrocross is a more recent but less


HIGH SCORE
100000
PLAYER 2
0
0
ROUND 1 TIME 0'26"4
AREA

Metrocross

TAU CETI III
RCEMA 00:01:40
FORWARD LAUNCHED
TARGETTED
TRACKED
MIS :7
AMM :8
FLAR :8
Gal-Corp Lander.
>LAUNCH
Missile Launched
Robot AMM Activated
Robot Missile fired
Height :
Shield :
Fuel :
Laser :
Speed :

Tau Ceti

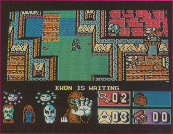
well-known, coin-op conversion in which you must complete an obstacle course within a time limit. In your way there are hurdles to trip you, giant barrels to squash you, potholes to plummet into and slowdown tiles which put the brakes on and lose you valuable seconds. On the positive side, you will find springboards to give you a lift and a skateboard to carry you to the finish.

I think Tau Ceti was one of the best space exploration and combat games of its time and now it's back as part of Mastertronic's Ricochet range. In the game you control a skimmer vehicle in a desperate mission to power-down the defence systems of Tau Ceti III which were turned renegade by a freak meteor storm. This is far from easy as you have to battle with the Hunter attack-craft while collecting reactor rods from the reactor substations so that they can be used to power-down the system controlled by the main reactor.

These substations are spread throughout the cities of Tau Ceti which are connected by a network of jump pads and patrolled by still more hunters.

Mastertronic's Vectorball seems the most promising of the specially written budget games, an area once again dominated by Mastertronic. It's a two-player, futuristic sports game fought out on a vector-graphic pitch full of hollows, peaks and waves. The aim is to control your spinning player and knock the ball into a human, or computer, opponent's goal area. It's very pretty to look at but incredibly difficult to play.

Kane II is the wild-west sequel in which you must shoot bad guys who are travelling or a train, capture Fort Apache to rescue a princess and then ride a bucking bronco before escaping across some treacherous terrain.



Karate Ace

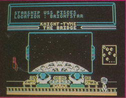
Knight Tyme is the second in the series of games featuring Magic Knight. Having survived the ordeal of Spellbound, you now find yourself onboard the USS Pisces in the 25th Century. If you're to get out of this mess, you'll have to contact the Tyme Guardians to get a Tyme machine while keeping out of the way of the Space Pirates and the Paradox Police. The Windimation system, animated characters combined with windows contain adventure-style commands, mixes well to create a true arcade adventure.

Super Cup Football is from the Hewson/Mastertronic Rack-it label and is a top-down view, soccer simulation that is similar in many ways to the World Cup table-top arcade machine.

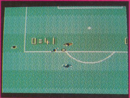
Full price games

Karate Ace is a compilation of martial arts games that pack a few punches as well as some chops and kicks. Compiled by Gremlin Graphics, the pack includes Way of the Exploding Fist (the Grand Master and daddy of them all), The Way of the Tiger, Samurai Trilogy, Bruce Lee (more like a platform game), Kung-Fu Master, Avenger (Gauntlet - kung-fu style) and the judo game, Uchi Mata. If you don't feel like you could take on all-comers after playing that lot, you never will!

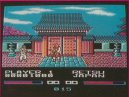
Summertime Specials is the latest US Gold compilation which features hits from the past. This six-pack



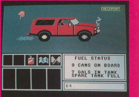
Knight Time



Super Cup Football



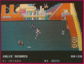
Street Fighter



4 x 4 Racing

includes World Class Leaderboard, Solomon's Key, Bravestarr, Captain America, Trantor and the coin-op conversion, Rygar.

Street Fighter is a game for people who want to fight around the world and actually features two version of the game in one box. They couldn't decide which was the better the public when they received the US and UK versions and decided to let the public decide. I'm afraid the patriots are in for a disappointment as the US version is streets better.



Street Sports Soccer

Street Sports Soccer is Epyx's (US Gold) version of how football is actually played, so you can forget Wembley and head instead for the park or the alley for a three-a-side game with the local kids. The goals are made out of piles of boxes or cans and you can play for a set amount of time or up to a number of goals. The most important part of the game is to win the toss so you get first pick for sides.

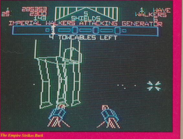
The original Pink Panther is back in a Gremlin game. He's broke, so he gets a job at a mansion house but really goes to work at night by helping himself to the family jewels. It's not going to be easy because the owner sleep-walks and you have to steer him away from objects that will wake him up and you'll be caught red-handed.

4x4 Off Road Racing takes car racing from the safety of the track to a series of terrains that will test you, your car and especially its tyres. The races are a mixture of driving skill and mechanical expertise in which you have to patch up your car as you go along, so you have to ensure that you have the parts you'll need before you set off.

The Empire Strikes Back is Domark's second instalment in the Star Wars trilogy in which the player stars as Luke Skywalker. This time he's flying a skyspeeder against the Empires probots, walkers and, finally, its tie-fighters. If you enjoyed Star Wars then you'll like this as it's more of the same and, for the real Star Wars addicts, Domark is adding the final touches to the Return of the Jedi which ought to be out soon.

US Gold caused a great controversy with its chauvinistic advertising campaign for Psycho Pigs UXB, so it's nice to see the game behind the posters at last. You play a Psycho Pig surrounded by a screenful of equally psycho pigs and must wipe them out by picking up and hurling bombs at them. This sets off a timer which explodes the bomb when it reaches zero. That's all there is to it. It's one of those ridiculously addictive games that you play over and over without quite knowing why and it would make a great budget game — unfortunately, it isn't.

Tony Hetherington



The Empire Strikes Back

Learn to conceal messages and how to protect your Basic programs with a top secret password

Secret Writing

The Spartans did it, the Romans also, World War II armies did it and the Russians and Americans are still doing it. Throughout history people have exchanged secret messages in the hope that others could not pry into their affairs. The only way they could achieve this was by use of a secret code or cipher to disguise the actual text.

Even inside the workings of a computer there are code languages and text, such as machine code, Binary Coded Decimal or even the ASCII code. Most programmers are already familiar with these and there is nothing secret about them.

The study of secret writing is given the name 'cryptology' and the process by which an ordinary message is concealed is called 'encryption'. Depending on the type of encryption used, this process will transform the message into a secret code or cipher. The difference between the two is that a code uses whole words or parts of the text during encryption, whereas a cipher operates on each individual letter.

Decryption is the name given to the process which transforms the message back to its original state. As codes are a bit more complicated than ciphers, this article and its accompanying programs will be based only on secret ciphers. The processes used with a cipher are given different names: to conceal a message the process is called encipherment, and the revealing of the message is called decipherment.

To get the ball rolling, lets take a look at a simple cipher and how it works. Julius Caesar used a very simple cipher whereby he would move the alphabet a number of places forward, starting from the letter A. For example, if we show the normal alphabet and one underneath which had been moved four places forward, you will see the difference (Diagram 1). In this context, when concealing a message, the letter A would be replaced by an E, letter B would be replaced by F and so on through the alphabet. If we were to encipher the words YOUR COMMODORE, the resulting text would become CSYV GSQQSHSVI which looks very different from its original lettering. You can, of course, move the alphabet as many places as you like but with only 26 letters in the alphabet it would be wise to stick with a number between 1 and 25. The golden rule is to use the same number in both enciphering and deciphering the text.

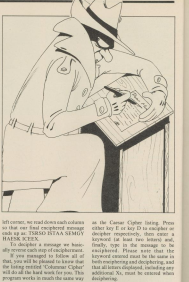
Because there can only be 25 possible configurations of this cipher, it is not very useful for protecting programs but it can easily be used to send secret messages to your friends. If you wish to experiment more with the Caesar Cipher then you can type in the listing at the back of the magazine. This program will do all the hard work of enciphering and deciphering for you, when you run it, you will be prompted for the mode required. First press key E to encipher and then enter the keynumber, which is the number of places you want the alphabet to be moved forward from the letter A. Next enter your message and a display of the normal and ciphered alphabets will appear with the keynumber and the message in normal (or deciphered) and enciphered states.

To decipher a message, press key

Diagram 1

Normal ABCDEFGHIJKLMNOPQURSUVWXYZ
Cipher EFGHIJKLMNOPQRSTUVWXYZABCD
(-4 places)

D on the main menu, enter any keynumber, then the enciphered message. From this point it is possible to go through each of the 25 cipher configurations until the correct deciphered message appears. If you follow the on-screen prompts, everything should run smoothly.



Keywords and grids

The Caesar Cipher is very easy to crack, one of the reasons for this is that the text is directly enciphered without further scrambling of the letters. The next example aims to combat this by using a keyword in the encipherment/decipherment process. This cipher is called a Columnar Transposition and also introduces the use of a grid in which we place each letter of the message.

If we choose a keyword such as CODES and a simple message: THIS IS A SECRET MESSAGE OKAY. This contains 24 letters, so the first step of encipherment would look like Diagram 2(a). As you can see, the message is placed in the grid starting at the top left corner. The actual grid size is constructed by placing each letter of the message into the columns under the Keyword until all the letters have been used. In this example an empty space is left which has to be filled. I have chosen the letter X for filling and this can be seen in the bottom right corner of the grid.

The next step is to put the letters of the keyword into alphabetical order. During this process, as each letter in the keyword is moved, the whole of the column below it in the grid is also moved, after which the text in the grid ends up looking like Diagram 2(b).

In the final step, the letters are read back from the grid. Starting at the top left corner, we read down each column so that our final enciphered message ends up as: TSRSO ISTAA SEMGY HAESK ICEEX.

To decipher a message we basically reverse each step of encipherment.

If you managed to follow all of that, you will be pleased to know that the listing entitled 'Columnar Cipher' will do all the hard work for you. This program works in much the same way as the Caesar Cipher listing. Press either key E or key D to encipher or decipher respectively, then enter a keyword (at least two letters) and, finally, type in the message to be enciphered. Please note that the keyword entered must be the same in both enciphering and deciphering, and that all letters displayed, including any additional Xs, must be entered when deciphering.

KEYWORD

C	O	D	E	S
T	H	I	S	I
S	A	S	E	C
R	E	T	M	E
S	S	A	G	E
O	K	A	Y	X

Diagram 2(a)

KEYWORD

C D E O S

C	O	D	E	S
T	I	S	H	I
S	S	E	A	C
R	T	M	E	E
S	A	G	S	E
O	A	Y	K	X

Diagram 2(b)

COLUMNS

ROWS	1	2	3	4	5
1	C	O	M	P	U
2	T	E	R	A	B
3	D	F	G	H	I
4	J	K	L	N	Q
5	S	V	W	X	Y

Diagram 3(a)

MESSAGE:-	I	L	O	V	E	Y	O	U	S	U	S	A	N
ROWS:-	3	4	1	5	2	5	1	1	5	1	5	2	4
COLUMNS:-	5	3	2	2	2	5	2	5	1	5	1	4	4

Diagram 3(b)

ROWS:-	3	1	2	1	5	5	4	3	2	5	5	5	4
COLUMNS:-	4	5	5	1	1	2	5	2	2	2	1	1	4
RESULT:-	H	U	B	C	S	V	Q	F	E	V	S	S	N

Diagram 3(c)

Many more ciphers

The final cipher is based around an old fractionating method which is much more sophisticated and tougher to crack than the previous examples. First of all, take any keyword (preferably large), and mix this with the alphabet in a 5x5 grid which has its rows and columns numbered from 1 to 5. If we use a keyword such as COMPUTER, the resulting mix with the alphabet would look like Diagram 3(a). As you can see, the keyword is placed into the grid starting at the top left corner, or the co-ordinates 1,1 (row 1, column 1). You may also notice that there is no letter Z, this is because there are 26 letters in the alphabet and only 25 possible places in the grid. The standard way around this would be to place two letters in the same grid position but it's easier to leave out the Z and this should not be detrimental.

In the next step we encipher a message by locating each letter's co-ordinates in the grid and writing them down. Letter J, for instance, has the coordinates of 4,1 and if we apply this to a piece of text such as: I LOVE YOU SUSAN then the coordinates of Diagram 3(b) would be produced.

The next step is to mix up the row and column digits. This is achieved by reading along the row co-ordinates and rewriting the digits by alternating between row and column. the same is then done with the column co-ordinates. If we do this to the first four row digits of Diagram 3(b) then the resulting co-ordinates would become (3,4) (1,5) (2,5) until (2,4). The series would continue with (5,3) (2,2) (2,5) through to (4,4). Fully transposed, we end up with the coordinates as in Diagram 3(c).

The final stage of encipherment involves the conversion of the co-ordinates of Diagram 3(c) back into letters. This is done by locating the letter corresponding to each new co-ordinate on the initial grid in Diagram 3(a). After doing this, our enciphered text becomes HUBCSVQFEVSSN.

For those of you that wish to experiment with this cipher, the listing entitled 'Fraction cipher' has been included.

On the main menu press either key E or key D to encipher or decipher. As in the last cipher you will be required to enter a keyword and then the message. Use only letters A to Y and no spaces. The program will display the grid with the mixed keyword and your message.

Although this article only considers three methods of coding, there are many other ciphers going under titles such as substitution, block transposition, polyalphabetic and fractionating ciphers and to explain all these would require a whole book. If this article has enticed you into the world of secret writing, then I suggest a trip to your local library, where you should be able to find further references.

Protecting a program

The basic idea behind any cipher is, of course, to stop anybody else from reading what you have written, but they can also be used for other applications. 'Password Protector' will save out a Basic program whereby your own password must be entered before the program will run.

Password Protector is written in machine code and sites in RAM from $C000 to $C79E.

Before using the program, there are a few rules to obey. The Basic program you want to protect must be in memory and it must lie at the normal Basic start position of 2049 ($0801). Additionally, you must have at least 600 bytes of memory free to make room for the machine code deciphering section which is placed before your protected Basic program.

You can start Password Protector at any time with SYS 49152 where you will be presented with three choices. If you have a Basic program in memory that you wish to protect, press key 1 and you will then be prompted for the destination device for the protected version. Press either key D for disk or key T for tape. Next, enter a filename of up to a maximum of 14 characters. The last two characters of the filename will always be 'X' to help distinguish the protected file from others. You will then be required to enter a password of up to 15 characters but only letters A to Y can be used. After this, your protected Basic program will be saved out and you will be returned to the main menu.

Option 2 gives disk users a chance to read the disk directory, this can be used without corrupting any program in memory. The final option will return you to Basic.

Please note that you must remember to use the exact password when you reload the protected version or else the computer will reset, it might help if you use a note book to keep a record of any passwords used with their corresponding files and keep it somewhere safe.

Example Messages

When you have typed in the Basic listings for each of the ciphers, you might like to try the following enciphered messages. Before you use these examples though, make sure that you press key D to decipher, this goes for all of the examples. On the Caesar Cipher try this example: keynumber 10, message:

RSGOVMYWODYDROGYBVNYP
COMBODMYNOC.

On the Columnar Cipher try this: keyword COMMODORE, message: IMRXKXOSVILUECOXCX

On the Fraction Cipher try this: keyword GOOD INFORMATION, message: JWOFGMGQXCFGNRE MRESGWTR.

I hope that this article has uncovered some of the possibilities for using secret ciphers on your Commodore 64 and that you will experiment further. If so, I suggest you go out and get cracking!

Contributions

So you own a Commodore? So you've written some programs? So why haven't you sent them to us?

Your Commodore is always on the look out for new programs, hints and tips, articles and even regular series. In fact if you have something that you think could be of use to other Commodore owners we want to hear about it.

So if you have got something which you think we may be interested in. Hpw do you go about submitting it to us?

Below you will find a list of guidelines that will help us to deal with any item that you send in to us. We don't expect everybody to be the next William Shakespeare but if you do follow these simple rules then it will make our job a lot easier.

1) If possible all material sent to the magazine should be typed or printed out on a computer printer.

2) All text should be double spaced i.e. there should be a blank line between each line of text. You should also leave a margin of about 10 characters around the text.

3) On the very first page you should put the following:
   Name of the article
   Machine that it is for
   Any extras required – disk, printer etc.
   Your name
   Your address
   Your telephone number

4) The top of every page should have the following information on it:
   Abbreviation of the article title
   Your name
   The page number

For example, suppose you had submitted an article on C64 interrupts. You should put something like the following at the head of the page:

Interrupts/J.Smith/1

5) Please make sure that you do not make any additional marks on your text especially underlining.

6) Try and write in clear concise English, it does not have to be a work of literature but it must be comprehensible.

7) On the bottom of each page you should put the word MORE if there are more pages to the article or ENDS if it is the last page.

8) If possible, enclose a listing of all programs.

9) Under no circumstances use a staple to hold the pages together. Use a paperclip instead.

10) Programs should be included on either disk or tape. Make sure that you SAVE two copies of every program so that we have a better chance of loading them if problems occur.

11) Programs under 10 lines can be included in the text. If your program is longer than this you must enclose a disk or cassette.

12) If your article needs any artwork then supply clear examples of what is needed. We don't expect you to be an artist but we do need to see what is required.

13) Photographs, if necessary, must be either black and white prints or colour slides. We can take shots ourselves so don't worry about this too much.

14) Submissions of any length are welcome. If you have a five line routine that you think may be of use to someone else we welcome it just as much as a full blown six part series.

15) Payment varies quite a lot and depends on quite a number of factors, such as complexity of program, presentation of program, number of magazine pages it takes up etc. Payment is generally between £10.00 and £800.00.

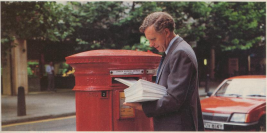
16) All payments are made in the month that the magazine containing your article has appeared in print.

17) If we do find your submission suitable for inclusion in the magazine we will write to you giving the terms of publication, the rate of payment and an agreement form. Prompt return of this form will allow us to use your program as soon as possible.

18) If you want the program returning to you, should we find it unsuitable for publication, then you should enclose a stamped self addressed envelope.

19) The last and most important point to make is 'get writing', we are waiting for your articles.

The day Roger Jackson sent his first mailshot.



I was impressed by the fact that Star have now produced a great looking little budget printer with a 24 pin head.

I was impressed by its excellent quality – the 8 resident fonts available and its high density letter quality helped me produce a really professional mailshot.

I was impressed by the extremely swift draft elite speed of 170cps and LQ elite at 57cps and the standard 7k buffer.

I was impressed by the special push-tractor feature that allows the LC24-10 the lowest possible tear off and its ability to 'park' continuous paper and load single sheets automatically – so there's no need to remove the continuous.

I was impressed by the touch-button front control panel that makes using the printer an absolute dream.

But most of all, I was particulary impressed with myself.

Because my Star LC24-10 was so inexpensive and no other printer comes close for sheer quality and value-for-money.

THE **Star** COMPUTER PRINTERS

Star Micronics U.K. Ltd.
Craven House, 40 Uxbridge Road,
Ealing, London W5 2BS.
Telephone: 01-840 1800.

A division of
Star Micronics Co., Ltd., Japan.

Please tell me how the Star LC24-10 can handle my printing needs.

Name ____________________

Company ____________________

Address ____________________

____

Postcode ______________ Telephone ______________

Or just call Belinda on 01-840 1829. 24 YC 10

Emergency Ward 64!

What can you do with a dead disk drive, deceased datasette or a clapped out Commodore?

by Kerry Fowler

Do you believe that your Commodore will go on forever without breaking down? What will you do when it falters? One recourse is to send it away for costly repairs but many of the faults can be repaired at home if you have suitable software.

The latest, and most comprehensive, range of home care kits form the Trilogic Doctor series. Other companies produce quite respectable kits but Trilogic's trio have taken the best ideas, refined them, added a few new twists and produced the packages at respectable prices.

Datasette Doctor

Ever since the plethera of fast loading tape systems arrived on the scene, they have proved to be both a boon and a bane. The benefit is the higher loading speeds, which in many cases equal the 1541 disk drive: the disadvantage is that head alignment becomes more crucial.

The tape head is the part of the datasette which reads magnetic impulses on a tape and converts them into electrical impulses which the computer reads as the zeros and ones of a binary coded program. These magnetic fields on the tape were originally created when the program was recorded onto the cassette.

The head consists of an almost complete ring of metal whose small gap is filled with an insulating material. The metal forming the ring is a magnetically inert alloy which can exhibit magnetic properties under certain conditions. These conditions are created by a current passing through a coil of wire which is wrapped around the arms of the ring.

When the current passes one way through the coil the north and south poles of the 'instant' magnet are found on each side of the insulation. When the current flows in the opposite direction these poles are reversed and when no current flows the ring is magnetically inert.

When a program is recorded onto the tape, the zeros and ones of the binary code is converted by the computer into a series of electrical impulses which are passed through the coils of the recording head. As this is happening the magnetic field across the head 'gap' is constantly being directly affected by the electronic signal.

A cassette tape is coated with magnetised particles which act like small bar magnets. As the tape passes across the recording head, these particles are energised by the head gap's changing field. The tape therefore becomes a continuous record of the changing magnetic fields which the original electronic signal produced.

In playback (load) mode, the tape passes across the head gap. The magnetic field caused by the tape as it passes across the gap causes a small electrical current to be induced in the coil which exactly matches the original signal. When this is amplified and fed back to the computer the signal is reconverted into the original binary zeros and ones, completely recreating the program in the computer's RAM memory.

The gap is a vertical slit which must lie at precisely 90 degrees to the direction of the tape travel. If the gap is only slightly out of alignment, the magnetic fields will not be exactly the same as those created by the recording head unless the recorder was similarly misaligned (this is why programs recorded by yourself may load easily when commercial tapes won't load at all). The head alignment is also referred to as the azimuth alignment.

Contrary to what may be believed, turbo loading tapes do not make the tape run faster. What happens instead is that the ROM program which normally converts the zeros and ones into electrical impulses is replaced by a RAM program which shortens the signal for a one or a zero and thereby compresses the recorded data onto a shorter length of tape.

Take the rather exaggerated examples of a signal, which lasts for one second, being recorded on a tape which moves at one inch per second. This means that the signal would occupy a one inch length of tape. The head gap, for this example, is a tenth of an inch so the azimuth alignment of the tape could be substantial adjusted without affecting the read signal.

Imagine that a turbo compresses this signal into an impulse lasting one tenth of a second, the head would have to be precisely aligned or the signals preceding and following the recorded 'bit' would significantly affect the magnetic field across the head gap.

With an actual recording, the times and measurements are much smaller and the head alignment becomes far more crucial. This is why turbos can cause such serious loading problems.

A secondary effect of the constant changes of field is that the heads can gradually collect a residual magnetic force which turns it into a very weak permanent magnet. Although it is unlikely that this residual magnetism will substantially affect a recording, constant passing and repassing of a tape across a magnetised head will weaken a recording by partially erasing the signal and by confusing the induced impulses from the tape.

A third effect of the record/playback process is the collection of particles which are stripped off the tape as it passes over the head. Even though the head is smoothed to a highly polished finish, the abraisive effect of the tape-coating and the general deposits of grease from the air can give a grounding to anchor small particles onto the head. As more and more oxide coating is deposited, the head itself becomes more abraisive and strips off more and more of the tape coating. This deposit confuses the magnetic fields in the head gap, damages the recorded signal and spoils the tape to head contact.

Trilogic's Datasette Doctor pack is designed to eliminate all three causes of loading problems. The pack contains two cassettes, a screwdriver, head cleaning fluid and an adjustment scale and pointer. The two cassettes serve very different purposes; one is a recorded alignment program, the other is a head cleaner/demagnetiser.

The cleaner/demagnetiser should be used first to ensure that there are no extenuating circumstances which might make head alignment difficult to achieve. After cleaning, the first program can be loaded from the alignment cassette. On a very badly aligned datasette, a certain amount of fiddling may be necessary to get the program loaded.

The head alignment screw access hole is located just beneath the cassette 'door', above the centre of the rewind key. The screwdriver from the kit is placed through the centre of the adjustment pointer arrow and then inserted into the screw head through the access hole. The alignment scale is then positioned so that the arrow is pointing to the central bar on the alignment arc and securely fixed with blutak or sticky tape.

For a badly loading cassette recorder, a suitable position can be found by turning the screwdriver to the left or right, by degrees, within the bounds of the scale's arc. This could take some time as each position is set and a new load attempted.

Once the alignment program is successfully loaded, the instruction manual covers the alignment procedure adequately and the process is very simple to understand. Correct alignment is clearly indicated by the on-screen display.

Once the slow load alignment is set, the alignment can then be fine-tuned for turbo loaders by using the fastload alignment program which should load from the tape without any problems.

This is normally where azimuth alignment packages call it a day, but not so with the Trilogic system. The final program on the tape allows the recording abilities of the cassette to be tested. This test, which may be repeated for three different loading speeds, will show up faulty electronics or worn tape mechanisms, poor tape quality, or mains and TV interference. As the instructions point out, the worn mechanism or faulty electronics cannot be corrected easily, bad tapes should be discarded and interference can usually be avoided by moving the Datasette away from the source of interference.

Drive Doctor

Disk drives are notorious for misalignment problems and the cost of repair can be daunting. Home therapy for a maladjusted drive takes a great deal of courage and care but it's not outside the reach of the majority of disk users with Drive Doctor.

The Doctor's main advantage over the opposition is that the test program is stored on cassette and can therefore be loaded even when the disk drive is totally disabled by alignment problems (you did remember to get Datasette Doctor, didn't you?). Included in the kit is a perfectly aligned disk which is supplied purely as an aid to correcting wayward drive heads and contains no alignment program material whatsoever.

The kit can perform five tests on the drive but the instructions do not stress heavily enough the danger of having the internal mains supply unit exposed while the major tests are being carried out.

Starting with disk speed, the program allows you to make one of the simplest, yet crucial, adjustments that can cure loading faults. The speed adjuster is not easily accessed because it is located on the underside of the internal chassis. This means that the drive case has to be opened and the whole chassis removed.

The instructions are quite clear on how to achieve this and the variable resistor can be pinpointed in minutes (depending on how tightly the chassis is screwed in!).

The trick is to set the adjustment so that the screen displays the number zero constantly. If the number varies widely it's bad news and a visit to the repair shop may be necessary.

Head jamming is usually caused by a lack of lubrication on the head transport system, unless you've been particularly heavy handed on previous excursions into the drive's innards. The Trilogic test causes the head to travel back and forth along its track, if it sticks – lubricate.

The head needs to know where to find the tracks on every disk so a reference point is given by the back stop. This is the root cause of the horrendous bashing noise that emanates from the drive when the NEW command is used to initialise a disk.

As soon as NEW is executed, the head mechanism pulls back to the outside edge of the disk where the back stop is located. After a few thumps, the drive knows that the motor will normally carry the head to the correct track positions, but what if the back stop is worn or has moved?

This is where the Drive Doctor comes into play. The stop test pulls the head back to the stop, attempts to read a track which should display asterisks across the screen. If this doesn't occur, the head can be positioned for an adjustment which can try the patience of a saint!

The yuppie solution to a noisy back stop is to fit a 'soft' quiet stop which replaces the hard stop with a springy wire somewhat similar to the multi functional bent paperclip. The problem with this fix is that the head bounces off the wire and can have problems finding the correct track position. Even if this doesn't affect the drive's performance, you can guarantee that the wire will soon bend away from its true position.

After the stop is positioned a secondary test can be applied. The hysteresis test places the head on a particular track. The head is then pulled back to the stop and allowed to return to the original track. If this is successful, the drive stop is okay and you can be fairly sure that the head is not jamming.

The final test is the biggie – head alignment. This is tricky and can completely foul up a healthy drive, so take a tip from me and try all of the other tests first. Resist the temptation to try this test just for the hell of it or you may regret ever buying the Drive Doctor. This is for drives with a terminal illness, not for drives that are a bit off colour. By all means run the test program but, if the report looks reasonable don't try to get a perfect readout. Only one in a million drives can reach perfection – and it isn't yours!

As alignment tests go, this is sheer bliss to use. The screen display is easily understood by the non-technically minded but the adjustment isn't easy. It involves slackening off the heavily lacquered screws which hold the drive motor in position and then twisting the motor housing to achieve good results on both inner and outer tracks. The adjustment can often upset the stop position so a lot of test and test again methodology is involved. Only for amateurs with guts, so... do you feel lucky?

64 Doctor

This purports to be a 'professional diagnostic cartridge for your 64' but some of the facilities leave me with a few questions. The program is contained on a cartridge ROM and the kit also includes various specially wired plugs so that the output ports can be tested.

The suite of tests start off with a test which displays a C64 keyboard on the screen. Press a key and the screen registers success by reversing out the corresponding screen display key. If any of the keys fail to respond the absolutely excellent manual will point you in the right direction for fault finding.

Next, the joystick ports can be tested in a similar way and devices such as paddles or analogue joysticks can also be used to test the A/D converters.

The final screen displays the I/O ports and associated chips. Any faults detected are indicated on the screen. This test also checks the banking capabilities of the VIC chip.

Although this package is better than nothing, it doesn't do a lot for its keep. The other two Doctor packs give exhaustive tests, this one merely checks the in and outs. A better name for it would be the C64 I/O Doctor.

Although I am unimpressed with the cartridge, I am *very* impressed with the manual which, though brief, does give some good pointers to fault finding on the C64 generally. Already I have managed to revive a dead 64 which apparently had an ailing VIC chip but, thanks to the manual, I found that the 'fault' was a secondary effect caused by the demise of another component.

This is the most expensive package of the Trilogic trilogy and really only for the technician who can desolder chips and replace them without overheating the contacts. £18.99 is rather a lot to pay to find out that your 64 is not working which I'm afraid is all that many people will be able to determine with this package.

Triumphant Trilogic

Congratulations to Trilogic for biding their time and watching the opposition falling into the pitfalls that await the producers of diagnostic and repair programs. What they have ended up with is a set of programs which will certainly appeal to a wide range of people. Each pack is well thought through and leaves it up to the individual to judge if they have the knowledge or ability to employ it to the full.

Touchline:
Supplier: *Trilogic, Unit 1, 253 New Works Road, Bradford BD12 0QP.*
Tel: *(0274) 691115.* ***Machine:*** *C64.*
Prices: *Datasette Doctor £8.99, Drive Doctor £14.99, 64 Doctor £18.99.*

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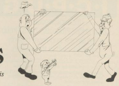
Painless Windows



Program your own pull-down menus and let this routine tend your WINDOW boxes

This collection of utilities provides the programmer with tools to extend the application of Commodore's own WINDOW Basic command. These enable up to 16 restorable windows to be defined with clearly marked edges, without any merging of text across window boundaries while retaining the facility for the screen to be restored to the state prior to the window being displayed.

The utilities are simply called via the 'SYS' command within Basic or a 'JSR' within a machine code program. The source code occupies the position normally used by the RS232 buffers and uses the four available zero page addresses between $FA and $FE for indirect indexed addressing. The zero page addresses of $FF and $A7 are also used, $FF for bank selection in the store and restore routines and $A7 as a counter for the last window to be stored.

Programmer's checklist

1. Check window size before calling the border routine.
2. Initialise $A7 to zero as part of program initialisation routines.
3. Retain startup text screen location.
4. Ensure no channels are opened to device '2' the RS232 otherwise the routines will be destroyed.
5. Do not attempt to restore a screen until one has actually been saved in memory as this may cause the program to crash when an attempt is made to restore the window parameters.

Here's a quick guide to the main inclusions required for a Basic program:

```
10 POKE 167,0:                 REM PART OF INITIALISATION

20   ------------ rest of program ------------

1000 SYS3075:                  REM SAVE SCREEN TO MEMORY

1010 WINDOW10,10,25,20,1:REM DEFINE WINDOW

1020 SYS3072:                  REM DRAW WINDOW BORDER

1030 ------------ rest of program ------------

2000 SYS3078:                  REM RESTORE SCREEN
```

```
00C00    JMP    $0C09
00C03    JMP    $0C80
00C06    JMP    $0CC2
00C09    LDX    $F4
00C0B    INX
00C0C    LDA    $C033,X
00C0F    STA    $FA
00C11    LDA    $C04C,X
00C14    STA    $FB
00C16    LDX    $E5
00C18    DEX
00C19    LDA    $C033
00C1C    STA    $FC
00C1E    LDA    $C04C
00C21    STA    $FD
00C23    LDX    $E6
00C25    DEX
00C26    TXA
00C27    CLC
00C28    ADC    $FA
00C2A    STA    $FA
00C2C    BCC    $0C30
00C2E    INC    $FB
00C30    LDX    $E6
00C32    DEX
00C33    TXA
00C34    CLC
00C35    ADC    $FC
00C37    STA    $FC
00C39    BCC    $0C3D
00C3B    INC    $FD
00C3D    LDA    $E7
00C3F    CLC
00C40    SBC    $E6
00C42    CLC
00C43    ADC    $03
00C45    TAY
00C46    LDA    $6E
00C48    STA    ($FC),Y
00C4A    LDA    $7D
00C4C    STA    ($FA),Y
00C4E    DEY
00C4F    LDA    $40
00C51    STA    ($FA),Y
00C53    STA    ($FC),Y
00C55    DEY
00C56    BNE    $0C51
00C58    LDA    $6D
```

The store and restore routines include read and write routines for the current window border parameters held in zero page locations from $E4 to $EC. The values are copied to 9 of the 24 bytes of screen RAM that are beyond the 1000 bytes of displayed RAM. These locations are not normally used but provide useful storage for the window border values, especially as the store and restore routines 'save' blocks of 256 bytes.

The store routine first checks location $7 to ensure that the maximum number of 'saved' screens is not exceeded. If this value would be exceeded then the routine returns without any further action. If the number has not yet been reached then the routine increments the count, copies the window parameters and 'saves' the screen plus 24 bytes (1024 bytes in all) to the RAM normally used by the 80-column screen.

The restore routine checks the value contained in location $A7 to ensure that the value does not fall below the value of zero. This ensures that the screen (and window parameters) are not restored from a source outside the 16K RAM of the 80-column screen. If the check fails, the routine gives control back to the program, otherwise the 1024 bytes are restored to the screen RAM and the count decremented. After this has been achieved the window parameters are restored to the correct locations within the zero page and the window redefined with a call to the ROM routine at $CA32 and the line pointers reset with a call to $C15C. Finally, control is given back to the calling program with RTS.

The last routine held within the block of code is also the longest and responsible for plotting a border around the outside of the currently defined window. The routine does not check what size window is defined, leaving this to the programmer. It is therefore very important for the programmer to be aware of the size of the current window defined because, when this window consists of the whole screen, the routine to draw the border will over-write the first bytes of the Basic program, unless the start of Basic has been moved.

The window border routine makes use of the table within ROM that contains the low and high bytes of the screen line start positions. A relocated screen will require the setting up of a new table within the routine because the ROM is not updated by the system after screen relocation. The line start tables are located at $C033 and C04C.

```
00C5A   STA   ($FA),Y
00C5C   LDA   $70
00C5E   STA   ($FC),Y
00C60   LDX   $E5
00C62   DEX
00C63   INX
00C64   LDA   $C033
00C67   STA   $FA
00C69   LDA   $C04C
00C6C   STA   $FB
00C6E   LDA   $42
00C70   LDY   $E6
00C72   DEY
00C73   STA   ($FA),Y
00C75   LDY   $E7
00C77   INY
00C78   STA   ($FA),Y
00C7A   CPX   $E4
00C7C   BNE   $0C63
00C7E   RTS
00C7F   NOP
00C80   INC   $A7
00C82   LDX   $A7
00C84   CPX   $10
00C86   BNE   $0C8B
00C88   DEC   $A7
00C8A   RTS
00C8B   LDX   $00
00C8D   LDA   $E4,X
00C8F   STA   $07F4
00C92   INX
00C93   CPX   $09
00C95   BNE   $0C8D
00C97   LDX   $A7
00C99   LDA   $0D21
00C9C   TAX
00C9D   LDA   $04
00C9F   LDY   $00
00CA1   STY   $FF
00CA3   LDX   $04
00CA5   JSR   $0D04
00CA8   LDY   $00
00CAA   LDY   $00
00CAC   LDX   $FF
00CAE   LDA   $FB
00CB0   JSR   $FF74
00CB3   JSR   $CDCA
00CB6   INY
00CB7   BNE   $0CAC
00CB9   INC   $FC
00CBB   LDA   $FC
00CBD   CMP   $FE
00CBF   BCC   $0CAC
00CC1   RTS
00CC2   LDX   $A7
00CC4   CPX   $00
00CC6   BNE   $0CC9
00CC8   RTS
00CC9   LDA   $0D21
00CCC   TAX   $0O
00CCD   LDA   $04
00CCF   LDY   $00
00CD1   STY   $FF
00CD3   LDY   $04
00CD5   JSR   $0D04
00CD8   LDY   $00
00CDA   LDA   $FB
00CDC   STA   $02B9
00CDF   JSR   $CDD8
00CE2   LDX   $FF
00CE4   JSR   $FF77
00CE7   INY
00CE8   BNE   $0CDF
00CEA   INC   $FC
00CEC   LDA   $FC
00CEE   CMP   $FE
00CF0   BCC   $0CDF
00CF2   LDX   $00
00CF4   LDA   $07F4,X
00CF7   STA   $E4,X
00CF8   INX
00CFA   CPX   $09
00CFC   BNE   $0CF4
00CFE   JSR   $0D31
00D01   DEC   $A7
00D03   RTS
00D04   STA   $FC
00D06   STX   $FD
00D08   STY   $FE
00D0A   CLC
00D0B   ADC   $FE
00D0D   STA   $FE
00D0F   LDA   $00
00D11   STA   $FB
00D13   LDX   $12
00D15   LDA   $FD
00D17   JSR   $CDCC
00D1A   INX
00D1B   LDA   $00
00D1D   JSR   $CDCC
00D20   RTS
00D21   BIT   00
00D22   BIT   04
00D23   BIT   08
00D24   BIT   0C
00D25   BIT   10
00D26   BIT   14
00D27   BIT   18
00D28   BIT   1C
00D29   BIT   20
00D2A   BIT   24
00D2B   BIT   28
00D2C   BIT   2C
00D2D   BIT   30
00D2E   BIT   34
00D2F   BIT   38
00D30   BIT   3C
00D31   JSR   $CA32
00D34   JSR   $C15C
00D37   RTS
```

LIFESAVERS 11 | C64 | KEY-BEEPER | 1/1

Many computers make a sound every time that you press a key on the keyboard. This routine allows you to have this facility while programming in Basic. This is great if you type in listings and spend more time looking at the magazine than the keyboard.

The routine works by re-directing the IRQ interrupt at $0314 to a new routine in free RAM, starting at 679 ($02A7). After poking the data into memory just enter:

```
SYS 679
```

to hear a beep on every key press.

If you don't like the sound that is set up by the program then you can change it with the following pokes:

```
POKE 730, WAVEFORM
POKE 705, VOLUME
POKE 720, NOTE (high byte)
POKE 725, NOTE (low byte)
```

To turn the routine off enter:

```
SYS 750
```

Neil Higgins

```
10 REM ****** KEY-BEEPER *****
*
20 FORL=679TO763:READA:POKEL,A:B
=B+A:NEXT
30 IFB<>10502THENPRINT"DATA ERRO
R":END
40 SYS679
50 DATA 120,169,180,141,20,3,169
,2
60 DATA 141,21,3,88,96,166,197,2
28
70 DATA 251,240,49,134,251,224,6
4,240
80 DATA 43,169,15,141,24,212,169
,0
90 DATA 141,5,212,169,240,141,6,
212
100 DATA 169,28,141,1,212,169,0,
141
110 DATA 0,212,169,17,141,4,212,
160
120 DATA 227,32,179,238,200,208,
250,169
130 DATA 16,141,4,212,76,49,234,
120
140 DATA 169,49,141,20,3,169,234
,141
150 DATA 21,3,88,96,141
```

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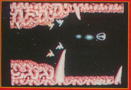
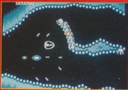
GOTO 20
NONSENSE IN BASIC
LOAD
ERROR
LOADING ERROR
VISA





Salamander

Beyond infinity lies the evil galaxy dominated by the forces of the despotic Salamander.

A hero is required who can persuade his compatriots to join him on a journey into Hell and beyond. Surprise, surprise you're that hero.

Your ultimate objective is to destroy a giant brain that controls the Salamander's forces but before that you will have to pilot your tiny craft through massive mazes that are packed with organic monsters.

In this game, the sequel to Konami's Nemesis, you have only three ships with which to complete one of the toughest missions that you will ever have to face, in one of the best coin-up conversions you will ever play.

To succeed you navigate for consecutive levels, each offering a different challenge and range of foes and obstacles including Nuclear Spiders, raging infernos, caverns of despair and a powerful enemy at the end of each level that must be defeated to allow entry to the next level.

Although you begin the game with a single-shot laser as your only weapon, you can dramatically increase your firepower by collecting bonus pods and weapons which appear each time you destory an entire wave of aliens or one of the special aliens that only seem to appear in the most convenient places. By collecting these pods you can increase the frequency of the shots you can fire, speed up the ship to make it more manoeuvrable, and launch missiles that fire and run along the cavern's roof and floor picking off anything lurking there, or add up to three multiple units to your ship.

Multiples are incredibly useful devices that follow you about as if they were attached to your ship by a rope. They mimic your moves as best they can and fire when you do. A ship with three multiples, missiles and rapid firing lasers should be able to stop most things but be warned: this game lays traps for the unwary and over confident.

Your main foes in the first level are claws that grow out of the walls to grab you and occasionally hurl a bolt at you just for good measure. Once they've done this to you a few times you'll be ready for these, having learnt to fire at the segment of the body that's a different colour. That's the secret of Salamander. If you see a colour that doesn't match the rest of the monster, aim for it because that's the monster's weak point.

Unfortunately, just as you get the hang of this, the walls suddenly grow out to crush you, giant spikes appear in your way and missiles whistle in your direction. One of the most difficult traps to navigate is a section of wall that must be blasted away, only to find that it regenerates. You have to move fast to get through it while remembering to avoid the blasts from exploding, bulbous monsters.

At the end of each level there's always the giant mega-monster that must be slain if you are to reach the next level until your final confrontation with the Salamander's brain.

Every hit from a missile will cost you one of your lives unless you manage to wipe out one of the waves at the start of a level. This provides a shield that surrounds and flashes around your ship, giving you limited protection. Navigating the wall at the end of the first level will usually destroy the shield, leaving you vulnerable for the end-of-level conflict.

A superb shoot-em-up and one of the best coin-op conversions to date.

Touchline:

Title: *Salamander.* ***Supplier:*** *Imagine Software, 6 Central Street, Manchester M2 5NS.* ***Tel:*** *061-832 6633.* ***Machine:*** *C64* ***Price:*** *£8.95.*

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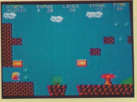
The Great Giana Sisters



When I was but knee high to a hedge-hopper, I can remember all the nasty things my parents used to say as they cajoled, threatened, beat me up and pleaded with me in an attempt to get me to go to bed. 'The bogey man will get you if you don't go straight to sleep.' and Father Christmas won't come if you're not good.

These threats only pertained to sleep itself though. The only reference to dreams that I can remember came from my grandmother who insisted that I would suffer from the most horrible nightmares if I ate cheese just before my nightly encounter with the bogey man.

If there is any truth in these stories, then the Giana sisters must have been shovelling down their parmesan suppers just as fast as their little fists could stuff it into their mouths! What started off as a dream has soon turned into a nightmare. Captured within a mysterious world, their only means of escape is to discover the whereabouts of a fantastic jewel. Finding it means that they will safely wake up at the other end of their journey, failure results in them never escaping from their worst visions.

The game is a variant on the old platform theme that seems to be making a bit of a of a comeback lately. Giana (her sister only comes into play in the two player version) must make her way across thirty-two sections as she attempts her quest.

The old restrictions of typical platform games have largely been removed. No longer do you have to make pixel perfect leaps or time very move down to the last split-second. Instead, you can travel across a section however you want with the one proviso that you cannot go back on yourself – the screen only scrolls one way.

Each section has to be completed within a set time limit. Failure results in the loss of a life, as does the more obvious calamities such as collision with a monster or falling off into a no-go area. Completing a section is not too difficult. What causes the problems is the pressure put on you to go out of your way to collect various objects.

Foremost amongst these are the diamonds that lie scattered about. Most of these are fairly accessible but there are usually one or two strategically placed to lure the careless jumper to their doom. There are also special bricks which can be head butted from below to release either another diamond or a bonus object.

The fascination with diamonds stems from the fact that you gain an extra life for every 100 you collect. The bad news is that this counter resets to zero every time you die.

The bonus symbols consist of lightning and double lightning bolts allowing Giana to fire dream-bubbles, gain extra lives, enjoy temporary fire resistance or have the ability to either put assorted nasties to sleep or make them vanish entirely.

Perhaps the most interesting feature in the initial stages of the game is the fire wheel. This transforms the sweet, innocent Giana into a vicious punk rocker with the ability to leap up and head-butt her way through solid rock as a useful way to collect extra diamonds. As with the diamonds, any of these bonus features disappear when you lose a life.

The levels steadily increase in difficulty so that there is always a challenge to face. Monsters can be jumped on, instead of merely having to jump over them all the time, although this can be a problem where there are several of them or you have a row of bricks over your head.

Look forward to encountering invisible items, dragons and hidden magic plus one extra feature without which, no platform game would be complete – the collapsing bridge.

One annoying feature is the lack of a save facility or a password system allowing you to skip levels previously completed. Whereas many other games offer a pause, this, too, is something that is missing from the C64 version. The graphics have been kept fairly simple and the screen has a very welcome, uncluttered feel to it.

The Great Giana Sisters is an excellent platform game and one which is, as the blisters on my joystick hand will testify, extremely addictive.

GRH

***Title:** The Great Giana Sisters*
***Supplier:** Rainbow Arts (or is it? See Data Statements).*

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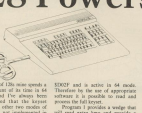


Learn how to use the full 128 keyset in 64 mode

By Dave Garside

Like a lot of 128s mine spends a fair amount of its time in 64 mode, and I've always been slightly annoyed that the keyset available in the other two modes of the computer is not implemented in 64 mode. Especially as there is actually no reason why the additional keys should not be available, except that to do so would have involved Commodore producing a patch for the 64 Kernal. This article shows how with a bit of prodding in the right place the full 128 keyset can be made to work in the 64 mode.

The standard 64 keyset is arranged in an 8 by 8 matrix. This matrix is read through the I/O ports of CIA 1; the relevant control registers are register 0 and register 1, which are mapped to $DC00 and $DC01 respectively. Briefly each bit in register 1 corresponds to the state of a key connected to each line. Now because we are dealing with an 8 bit machine, it should be clear that there can only be 8 lines of 8 keys: hence the 8 by 8 matrix, with simple arithmetic showing that only 64 keys can be read using this system. Note that the standard 64 keyset has 66 keys, but two, SHIFT-LOCK and RESTORE, are hardwired and separate from the main keyset.

In order to provide the additional keys, Commodore have built in an extra three control lines. Now, presumably in the interest of preserving compatibility, these lines are connected to the 40 column video chip and controlled through register 47 which is mapped onto the address $D02F and is active in 64 mode. Therefore by the use of appropriate software it is possible to read and process the full keyset.

Program 1 provides a wedge that will read extra keys and provide a value indicating which key has been pressed in the variable 'KEY'. The correspondance between key and value returned is given in Table 1. Program 2 provides an example of how the keys could be processed. The example places the ASCII value of the key pressed into the keyboard buffer in much the same way as standard key presses are processed. Non standard keys like 'ESC' are ignored. However a different set of processing could treat the additional keys as 24 extra function keys (more if 'shift' type operations are included).

As well as the source code for the two programs I've included two BASIC loaders which provide relocatable code for program 1 and Programs 1 and 2 combined for people without assemblers. To use, simply type in the programs, save and then run. The loader will then convert the BASIC data into a machine code file, prompt for a file name amd output device, and finally save out the machine code version of the program.

When the program is reloaded and run, the relocator will prompt for a start address, the address should be in normal RAM (i.e. not under BASIC) or the Kernal, or between $0800 and $OA00) and should be specified in hexadecimal starting at a page boundary (i.e. $4000, $4100, $4200 etc). The program will relocate to that address and then prompt for a decision on whether to run the program. A negative reply will result in the SYS address of the program start being supplied in decimal ready for later activation.

Table 1

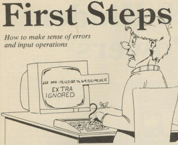
Value in KEY	**Key pressed**
0	HELP
1	8
2	5
3	TAB
4	2
5	4
6	7
7	1
8	ESC
9	+
10	-
11	LINE FEED
12	ENTER
13	6
14	9
15	3
16	ALT
17	0
18	.
19	cursor up
20	cursor down
21	cursor left
22	cursor right
23	NO SCROLL
255	no key pressed

NB. CAPS LOCK and the 40/80 DISPLAY keys are hardwired and not detected through the keyboard matrix.

See listing on page 63

First Steps

How to make sense of errors and input operations



Although many computer error messages relate to communications with peripherals, the majority are linked to faults that can arise in Basic programs. These may be broken down into three main areas.

The first area is mathematical errors which are relatively easy to correct. Then there are errors relating to inputs and character strings which are normally the fault of the program user but ultimately the responsibility of the programmer. Finally, there are operational errors which is always the programmer's fault and can be very difficult to correct.

The final category will form the subject of a whole article in a later issue of Your Commodore. In this article we'll concentrate on the input errors.

String too long

The maximum length of a string is 255 characters. Input from the screen through the INPUT statement is limited to less than 80 characters but use of the GET statement or string concatenation should be carefully planned during programming.

Weak areas are open ended statements such as:

```
10 GET A$:IF A$ =""THEN10
20 IF A$=CHR$(13) THEN 40
30 B$=B$+A$:GOTO10
```

The computer will carry on building the B$ string as long as the user is willing to type away at the keyboard. it is possible that the 255 character limit would soon be exceeded so a trap is needed:

```
25 IF LEN(B$)=255 THEN
PRINT"INPUT TOO LONG.
PLEASE TRY AGAIN":B$=""
```

If the input is deliberately long a different approach can be employed by using a routine like this:

```
10 X=0
20 GET A$:IF A$="" THEN 20
30 IF A$=CHR$(13) THEN 60
40 IF B$(X)=255 THEN X=X+1
50 B$(X)=B$(X)+A$:GOTO20
60 FOR A=0 TO X:PRINT B$(A);:
NEXT
```

Type mismatch

This occurs when an alphabetic character is typed in instead of a number. It can also occur within a program when a statement such as A$=A or A=A$ is used. The correct syntax would be A$=STR$(A) or A=VAL(A$). In the second case, the value would only be those of any numbers at the beginning of the string. If A$ starts with a letter it will not be suitable, even a floating point number such as 2.1E+30 would only be returned as 2.1 by this construct.

Extra ignored

This means that an input statement has received too many items. For example:

```
10 INPUT"LENGTH, BREADTH";
L,B
```

The extra information would be ignored if the input was 12,10,12. Only two items were expected but three were received.

This is a particular nuisance when string inputs are required:

```
10 INPUT"THE SECRET OF
LIFE";SL$
```

A possible response could be:

```
KEEP BREATHING, STUPID
```

The comma would confuse the computer into believing that STUPID was a separate input and this error would be flagged as extra ignored.

With strings it is usually best to use the GET A$ method because it's easier to error trap and accommodate commas, colons and semicolons.

Redo from start

Usually this arises when string data was typed in but numeric data was requested: a response such as 'seven' instead of '7'.

This error is fairly friendly because it does not crash the program but waits patiently for the user to twig to the correct keying-in procedure.

It can also occur when the HOME key is struck instead of DEL, sending the cursor to the top of the screen. This is read as a valid entry along with the copious keypresses which generally follow as the user replaces the cursor to the correct place.

As long as the user realises what the message means everything should be resolved by simply re-inputting the correct information.

Bad subscript

If any array element oversteps the preset limit the computer cannot cope and resorts to this message.

All variables automatically have the facility to have eleven elements such as A(0) to A(10). If A(11) is accessed the eleven is known as a bad subscript. If A(11) is needed, then a DIM statement will have to be placed at the beginning of the program.

The next set of errors contain the most commonly occurring messages of doom and form the operational error set. They can also be the hardest to track down so the next First Steps will be devoted to these important and irritating missives.

William Tell

Can you fight off the Austrian soldiers? Only time will tell

It's not often that a game meets our stringent standards but it was like a bolt from the blue when David Light made overtures with William Tell, we couldn't resist.

The program is entirely written in machine code and uses multiple sprite techniques to produce a game of fast reactions and joystick-gripping excitement.

William Tell's son has been captured by the Austrians and imprisoned in the deepest dungeon of the castle. Armed with a limited supply of crossbow bolts, you have to help Tell to rescue the apple of his eye.

The first stage of the game involves the collection of two keys which unlock the doors to the dungeons. Both keys are to be found hanging up outside the guardrooms located at either end of the battlements. The battlements are patrolled by armed guards who can either be shot with your crossbow or jumped over if your timing's good. Occasionally you must replenish your supply of crossbow bolts by jumping up and collecting them. Timing your jump is vital because arrows and cannonballs are whilstling overhead. Once you've got the keys, fight your way back to the ladder and then you can descend to the courtyard.

The second stage means fighting your way across the courtyard to one of the dungeon entrances which are at either side of the courtyard. It's up to you which entrance you choose but you must be in possession of both keys because the doors are double-locked. In addition to more swordsmen, you also have guards armed with longbows shooting arrows at you. The only way of avoiding these missiles is to jump over them but it's important that you replenish your supply of crossbow bolts during the first stage on the battlements because there are no more supplies until you enter the dungeons. If you have less than ten bolts remaining, the indicator starts flashing as a warning and you may have to return to the battlements to re-arm.

The final stage of the game takes place in the dungeons themselves. Here you have to collect 55 apples while being pursued relentlessly by intelligent guards who are also armed with longbows. You can shoot the archers and deflect their arrows with your own crossbow bolts but don't try to jump over the guards or their arrows. There are ample stocks of crossbow bolts distributed around the dungeons to replenish your supply.

Other hazards lurk deep within the dungeons, spinning blades appear that will chop you up if you walk or jump onto them. After frantically jumping over the blades and avoiding the guards, you may find an area in the dungeons where it seems you are safe from the pursuing guards but you could be in for a nasty surprise if you linger in one spot for too long! When you have collected all the apples you will be directed towards the exit where your son is waiting for you to shoot the final apple off his head.

Whether you complete the game, lose all your lives or the countdown timer reaches zero, you will be given the opportunity to enter your initials in the Hall of Fame as long as your score is greater than those already there. Use the joystick to scroll the alphabet left or right and press fire to select any three letters.

The program has 25 different screens (21 of which are scrolling) and three separate levels. Once the game has loaded, an animated title page which uses 24 sprites is displayed. When the animation is complete, the Hall of fame screen appears.

Getting it all in

Type in and save the programs in the order they are printed, following the instructions given. To start the game, press the fire button on the title or Hall of Fame screens. The title screen will be re-displayed at the end of each game once the Hall of Fame has displayed the top ten scores. Pressing RUN/STOP and RESTORE will abort the current game and return the title screen. The Hall of Fame scores will not be lost.

Are you bold enough to face this challenge? Can you save the boy? Who can? Tell!

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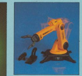

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Constructing a

To complete the FCL Compiler we present the all-important SYSLIB library file

The SYSLIB library file is given here as a Basic loader program. Unlike ASSEMBLE, you need not change the start of Basic because SYSLIB loads into memory at $C000, well out of reach of Basic.

Once assembled, your program is ready to be run on the computer; simply type LOAD "PROGRAMNAME",8 and then RUN. At runtime, your program expects the library file SYSLIB to be present on the disk. SYSLIB provides most of the facilities required by your program such as error handling and file I/O. The SYSLIB program was written using the FCL assembler and I should point out that all of the problems mentioned back at the beginning of the series occur within this code.

A program can call SYSLIB by loading a service request function number into the accumulator and then calling the library via an indirect jump at memory address $005E (94). Many of the functions assume that parameters are to be found in one or more of the system variables in zero page and most results are returned in this way. SYSLIB also sets up several buffer areas for file and keyboard I/O, runtime stack and numeric conversion.

It is possible for an end user to 'Patch' into SYSLIB by altering the indirect jump vector mentioned earlier. In this way, extra functions may be added. The user patch would test the value of the accumulator and, if it was one of the new function numbers, would execute the appropriate subroutine, otherwise the normal SYSLIB routines would be called.

The library is first initialised at runtime by a call from the compiled program to the initialised routine at $C000 (the library lives between $C000 and $CFFF although there is some spare memory here). This sets up the memory pointers and buffer areas for runtime operation. The actual zero page addresses of the system variables and pointers are listed in Fig 1.

The addresses of these variables have been carefully chosen so that they don't interfere too much with the resident Basic system. This ensures that a safe return to Basic may be made following execution of a runtime FCL program.

SYSLIB library calls

Fig 2 lists the calls to the SYSLIB program.

To make a call to SYSLIB, Place the parameters required into the correct system variables, load the accumulator with the function number and execute a JSR $005E instruction. After execution, any parameters are returned in the stated variables.

As you can see SYSLIB does quite a bit! As I have already mentioned SYSLIB also provides an error messaging facility. When an error occurs, the program will normally halt. When a warning is printed, execution continues although the operating conditions may change and results may not be as expected. All errors and warnings are listed in Fig 3.

Compiler complete

So there you have it. A complete compiler system, albeit a rather simple one. Given time and a lot of patience, many of you may be able to come up with bigger and better (and faster!) compiler systems.

In Fig 4, you will find a couple of example programs to try. They are pretty simple routines but may give you the feel of the language and show you the sort of things you can do.

If you do go on to write a compiler, good luck!

Fig 1 System variables

System name	Purpose	Address
AC1	Numeric accumulator 1	$03
AC2	Numeric accumulator 2	$05
SD1	String descriptor 1	$26
SD2	String descriptor 2	$3F
UP1	Utility pointer 1	$FB
UP2	Utility pointer 2	$FD
APT	Array pointer	$45
TT1	Temporary variable	$47
CALLVEC	SYSLIB call vector	$5E
MEMTOP	Top-of-strings pointer	$49

The buffer areas are as follows:

OUTBUF	Output buffer (write)	$9B00
INBUF	Input buffer (read)	$9C00
STACK	Runtime stack	$9D00

OUTBUF and INBUF are each 256 bytes in length while STACK is 768 bytes long. The pointer for STACK is held within the area of the stack routines and should not be changed even if you can find it!

Fig 4. Example programs

Program 1. Simple typewriter.

This program uses the charin and charout elements to construct a simple typewriter program which may be terminated by pressing the RUN/STOP key.

```
begin
  cls
  loop
    charout charin (0)
  endloop when stop (0)
end
```

Program 2. Multiplication tables program.

Back to school with this short program to display a multiplication table of your choice.

```
var int count,mult
;
begin
  count=1
  write "Enter table:";
  read mult
  loop
    write count, count*mult
    count++
  endloop when count 12
end
```

Fig 2 SYSLIB library function calls

Function number (A)	Action
00	PHOENIX. This call will reset SYSLIB and is used by the initialisation routines. The strings pointer will be reset to the end of the program and the stack will be cleared.
01	Place the contents of accumulator AC2 onto the system runtime stack. Contents of AC2 are preserved.
02	Remove the topmost runtime stack member and place it in AC1.
03	Copy the contents of AC2 into pointer UP1.
04	Copy the contents of AC2 into pointer UP2.
05	Copy the contents of string descriptor SD2 onto the top of the runtime stack.
06	Remove the topmost runtime stack member and place it in SD1.

Functions 07 to 12 assume that the two string descriptors, SD1 and SD2 contain pointers to two strings. Results from these functions are returned in accumulator AC2 where TRUE is a value of 1 and FALSE is a value of 0.

07	Compare the two strings and return TRUE if they are exactly equal.
08	Compare the two strings and return TRUE if they are NOT equal.
09	Compare the two string and return TRUE if SD1 = SD2.
10	Compare the two strings and return TRUE if SD1 = SD2.

11 Compare the strings and return TRUE if SD1 <SD2.

12 Compare the strings and return TRUE if SD1 SD2.

13 Concatenate (join) string SD2 to string SD1 returning the combined descriptor for the new string in SD2.

Functions 14 and 15 assume that the I/O channel has been opened previously by function 37 (open).

14 Select the channel number in AC2 for input.

15 Select the channel number in AC2 for write.

16 Convert the number in AC2 to an ASCII-numeric literal and output to the current (output) channel.

17 Write the string currently described by SD2 to the current (output) channel.

18 Write a carriage return (ASCII 13) to the current output channel.

19 Applies to screen output. Move the cursor to the next screen tab position; tabs set at positions 8,16,24 and 32.

Functions 20 to 22 calculate and check array addressing requests.

20 TT1 should contain the start address of the array. The first two bytes at this address contain the maximum number of elements. This function checks that the program is trying to address a valid element by comparing these bytes to the contents of the array pointer APT. An error will result if the element being addressed is invalid.

21 Calculate the address of the element in an integer array. Element number is in APT.

Functions 22 to 28 perform operations on arrays. You must use functions 20 followed by 21 or 22 to calculate the address of the array element to be used by these functions.

22 Calculate the address of the element in a string array. Element number is in APT.

23 Load AC2 with the value of the integer array element at the address calculated by function 21.

24 Save AC2 to the integer array element whose address was calculated by function 21.

25 Load SD2 with the descriptor from the string array element whose address was calculated by function 22.

26 Save SD2 to string array element whose address was calculated by function 22.

27 Increment the integer array element.

28 Decrement the integer array element.

29 Remove the topmost stack element and place it in the array pointer APT.

30 Copy the contents of AC2 to APT.

31 Read a literal numeric string from the current input channel and convert it into a value in AC2.

32 Read a string literal from the current input channel and place descriptor in SD2.

33 BSET. Move the contents of UP1 to the memory address contained in AC1.

34 WSET. Similar to 33.

35 Check if AC2 contains a FALSE value of zero.

36 CHAROUT. Output the ASCII character whose code is in AC2.

37 FOPEN. Opens an I/O channel. Either of functions 39 or 40 must be called first!

38 FCLOSE. Close channel AC2.

Functions 39 and 40 set up parameters for function 37, the open statement, and expect the filename string in SD2 and the channel number in UP1.

39 INPUT. Define a channel for input.

40 OUTPUT. Define a channel for output.

41 CLS. Clear the screen and home the cursor.

42 WAIT. Uses the value in AC2 to cause a delay calculated by 60*AC2.

43 HALT. Forces a terminate sequence. Similar to function call 78.

44 SYSCALL. Call a machine code routine at address in AC2.

Functions 45 to 58 perform operations between AC1 and AC2, returning the result in AC2. The exception is function 48 which uses only AC2. Functions 49 to 54 compare AC1 and AC2 and return a TRUE (1) value in AC2 if the condition is satisfied.

45 OR. Perform AC1 OR AC2→AC2.

46 XOR. Perform AC1 XOR AC2→AC2.

47 AND. Perform AC1 AND AC2→AC2.

48 NOT. Perform NOT (AC2)→AC2.

49 Test for AC1 = AC2.

50 Test for AC1<>AC2.

51 Test for AC1 < = AC2.

52 Test for AC1 > = AC2.

53 Test for AC1<AC2.

54 Test for AC1>AC2.

55 Plus (+). Perform AC1 + AC2→AC2

56 Subtract (-). Perform AC1 - AC2→AC2.

57 Multiply (*). Perform AC1 * AC2→AC2.

58 Divide (/). Perform AC1 / AC2→AC2.

59 Autoincrement (++). NOT IMPLEMENTED.

60 Autodecrement (--). NOT IMPLEMENTED.

61 BYTE. Get the contents of the memory location (AC2) into AC2 (single byte only).

62 WORD. Similar to 61 but gets a word.

63 LEN. The length of the string whose descriptor

is in SD2 is returned in AC2.

64 CHAR. The ASCII character code in AC2 is converted to a string in SD2.

65 STR. The literal of the value in AC2 is converted to a string in SD2.

66 ASCII. The ASCII code of the first character of the string in SD2 is placed in AC2.

67 STOP. A TRUE value is returned in AC2 if the RUN/STOP key has been pressed.

68 KEY. A TRUE value is returned in AC2 if a key other than SHIFT, COMMODORE, RUN/STOP or CONTROL has been pressed.

69 CHARIN. The current input device is polled for a character which is returned in AC2.

70 LEFT. Places in SD2 the substring of the leftmost (UP1) characters of string (SD2).

71 RIGHT. Places in SD2 the, substring of the rightmost (UP1) characters of string (SD2).

72 MID. Places in SD2 the substring of (SD2) of length (UP1) starting at (UP2).

73 SYSFN. Calls a machine code routine at address in AC2. The string (SD2) contains the values of the A,X,Y and flags registers to be passed to the routine. Upon return, string (SD2) contains the return values of these registers.

74 IOSTAT. Return the value of the I/O status byte in AC2.

75 DSTAT. Return the disk drive error code in AC2.

76 DERR. Return the disk status string in SD2.

77 Clear all I/O channels but do not close them.

78 Terminate. Calling this function terminates the current program. There is no return from this function!

Fig 3 SYSLIB error messages

SYSLIB warnings

Numeric overflow
A calculation has exceeded the integer limit of 65535 and may not contain a valid value.

Numeric underflow
A calculation has gone 'negative'; i.e. has effectively gone less than zero. In fact the value will be 2's complement.

WARNING Disk not present. Subsequent I/O attempts will cause errors
May be printed during the init phase. Indicates that a disk drive is not present.

SYSLIB errors — non I/O

Bad array subscript
An array has been illegally addressed.

Illegal quantity
Some value (possibly during a read) has exceeded the valid limits.

String too long
Strings must not exceed 255 characters.

Data type mismatch
May occur during a read. Indicates that incorrect data has been assigned to a particular variable.

System I/O error
General I/O error. More detailed messages follow later.

Reserved I/O channel
Certain channel numbers are reserved by the system. This messages is printed when you try to use one of them (See the FCL Programmers' Manual for a list of invalid channels).

Device not found
Disk drive is not present.

Null FID
A filename was null.

Out of memory
There is no more room for strings.

Division by zero
You cannot divide by zero!

Stack overflow
Unlikely, but occurs if the runtime stack fills up. This may indicate an error in COMPILE.

SYSLIB I/O errors

These I/O errors are more specific and are actually used to report Kernal I/O errors (See Commodore 64 Programmers' Reference Guide for details of Kernal routines).

STOPed
An I/O operation was terminated by the RUNSTOP key being pressed

Too many open files
The system cannot maintain more than about 6 concurrently open files

File already open
You have used the same channel as a previous (still open) I/O

File not open
A channel you have used has not been opened

File not found
The system cannot find the file you have requested for INPUT

Device not present
The device asked for was not available

File is not an INPUT file
You have tried to read from an OUTPUT file

File is not an OUTPUT file
You have tried to write to an INPUT file

File name is missing
You cannot open a disk file with no name

Illegal device number
The device number specified is not legal. May indicate a problem with SYSLIB itself.

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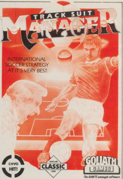
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Guess who has got to save the world again? Invaders from a distant star have smashed the Earth to bits. As the sole survivors, you and a few like-minded individuals have pledged to uphold the laws of justice, revenge and other clichés. One man has to face the final challenge and become the Vindicator. Have you noticed how it is always one man. What's happened to the rest of the survivors? Perhaps they are not so keen on upholding the laws of justice, revenge and other clichés as they claim to be - but I digress.

A quote from the packaging blurb gives you some insight into the enormity of the task facing you. 'Across a tortured landscape, against incredible odds, he must battle through to the enemy stronghold, down into a maze-like corridor filled with mutated guardians until he reaches the inner sanctum of the dark overlord to strike the final blow of retribution...' It's beginning to sound as if you drew the short straw.

The task comes in three sections. In part one, you have to blow up the Alien Vanguard and their base. This complex is set out as a four-level maze in which you must find the computer rooms. These, in turn, will give details to the whereabouts of the bomb parts necessary for the destruction of the base.

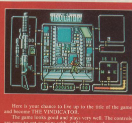
Before you can access the computers though, you must first kill off vast numbers of aliens that patrol the rooms off the corridors. Green ones are easy to kill - you can just duck out of the way of their bullets - but the red ones are much harder to despatch and you will need bigger and better weapon cartridges if you are not to sustain considerable damage yourself.

Having killed the alien, you can then pick up his lift pass, computer access card or an extra cartridge. Other items to be acquired include oxy-gum - a health restorer used to repair damage either from being shot or simply from inhaling the poisonous atmosphere.

Once you have found a computer terminal and accessed it with the correct card, you then have to solve an anagram before you are given the information you desire. The solutions to these are not immediately obvious but a reference to some of the names connected with the design of the game may put you on the right track. Losing one of your lives also results in the loss of any cards you are carrying at the time.

Having blown up the base, you now have to fly a commandeered fighter plane across enemy terrain blowing up as many of the installations as possible. The problem is that there is nowhere to land so you must return to the start and then make the journey again, this time in your jeep. Hordes of tanks and helicopters are out to get you but that shouldn't prove too difficult for a budding superhero. Once you reach the other end, all that remains is for you to defeat the Mutoid Guardian before gaining access to the final part of the game.

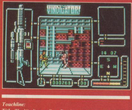
The Catacombs lead you to the bowels of Hell itself. Apart from avoiding the hordes of evil minions, it is purely a case of keeping on going until you come to the final confrontation with Gog - the personification of evil and the ultimate objective of your quest.



Here is your chance to live up to the title of the game and become THE VINDICATOR.

The game looks good and plays very well. The controls are easy to get to grips with, unlike some other games of this type. The only real problem you are going to encounter is that of orientating yourself properly in the corridors. The easiest way round that is to make a note of the co-ordinates of all the key installations - these are constantly updated as you wander around the mazes.

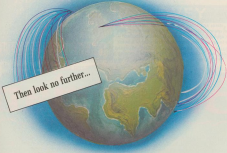
If I have one major grumble, it is that you cannot store supplies of oxy-gum in a pocket (surely even superheroes have pockets) but have to leave it where it is until required. That apart though, The Vindicator is an excellent challenge and anyone enjoying this type of game will surely want it in his or her collection.



Touchline:

***Title:** The Vindicator. **Supplier:** Imagine Software, 6 Central Street, Manchester M2 5NS. **Tel:** 061-832 6633. **Price:** £8.95 (cass), £14.95 (disk).*

LOOKING FOR SOMETHING OUT OF THIS WORLD?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Total £...........
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A5B2

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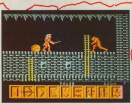
DATABASE EXHIBITIONS

Not the Palace hit, but a conversion which is already a 16-bit cult.



Barbarian

When it first appeared on the Amiga and Atari ST, Psygnosis' Barbarian immediately gained cult status and I suppose it was only natural that it would be converted to eight bit formats. The conversion has now appeared on the Melbourne House label and I am sorry to say that they have made something of a botch of it.

The storyline is convoluted to say the least, running to some twenty pages in the instruction booklet. What follows is a (very) potted history. You are Hegor the Barbarian. When you were young, your father, Thoron, trained you in the use of various weapons. One day, you return home to see him being beaten to a pulp by a dragon which he had just lured away from the village thereby gaining, but posthumous, hero status. You immediately vow your revenge.

To while away a few years, you go off practising all the usual barbarian-type habits such as drinking and wenching a lot while killing the odd monster. During these travels, you discover that your father's enemy, the controller of the dragon, was in fact your Uncle Necron, your father's twin brother. Your father had killed Necron once but, because of the family ties, let his soul regenerate.

Necron is now terrorising the world again and there is a prize of a kingdom to anyone who can defeat him and his dragon Vulcuran. This seems to interest you rather more than your previous vow of vengeance but the ghost of your father appears and reminds you of your duty. Confused? Don't worry, it's all incidental to the game.

Hegor is controlled via a series of icons although the instructions cunningly don't bother to tell you what they are for. At least not in English they don't! They do in French, German and Italian although one of the French commands is also missing. This is obviously a plot by Mastertronic/Melbourne House to get everyone learning a foreign language.

For non linguists, the available commands include left/right, up/down, jump, stop, run away, attack, defend, pick up, drop and use. A cursor is moved over the appropriate choice and the fire button is pressed to execute an action. Being used to the Amiga version using the mouse, I found the joystick response to be very slow and got killed several times through being unable to execute combination moves quickly enough.

The game involves traversing a number of screens by killing off monsters or by trying to leap over falling masonry, collapsing bridges and the like. Amongst the monsters to be encountered are tin men, strange rhinos and woolly bears. You start off armed only with a sword but must find and pick up other weapons en route, such as a bow and arrow which is required to dispose of the dragon. Eventually, you will find the crystal that represents Necron's soul and you must drop this in the volcano. You then have only a limited amount of time to make your escape before the volcano erupts.

The traps appear one at a time at first but soon they are found acting in combination with monsters. One trap I didn't like involved a falling slab of spiked stonework which could be avoided by standing underneath it and jumping upwards!

Although comparisons between eight and sixteen bit versions are difficult, the graphics and sound effects on the C64 version are poor, especially the graphics which look very fuzzy. Even the stunning Amiga title screens, which could have been reasonably reproduced, have been replaced with Invade-a-load.

It is the gameplay that has suffered most. The monsters have lost all their aggression and there is a general woolliness about the controls. Coupled with the very shoddy instruction booklet, this all makes for a very disappointing product.

The Amiga version was on the office machine all the time. Everybody wanting to have just one more go. On the C64, I found no addictive qualities whatsoever and couldn't wait to turn the machine off. **GRH**

Touchline:
Title: *Barbarian.* ***Supplier:*** *Melbourne House, 2-4 Vernon Yd, Portobello Rd., London W11 2DX.* ***Tel:*** *01-727 8070.*
Machine: *C64.* ***Price:*** *£9.99 (cass) £14.99 (disk).*

YOUR COMMODORE

READERSHIP SURVEY

25 Free subscriptions must be won!

If you would like to receive a copy of your favourite magazine FREE for 6 months, simply complete this questionnaire and return by 11th November 1988 and you could be one of the lucky 25 people to win a 6 month subscription to YOUR COMMODORE.
Some of the questions are of a more personal nature and do not directly relate to the magazine. Answers to these questions help us present an overall profile of our readers and their lifestyles to advertisers who require such data for selecting suitable magazines for their products.
No names and addresses will be supplied to third parties and all details will be treated in the strictest confidence by the publisher.
We would like to thank you in advance for your time, and remind you that only fully completed questionnaires received by 11th November 1988 will be eligible for the FREE draw.

---

1. How long do you keep your copies of YOUR COMMODORE for:

Less than one month ☐
One month ☐
Three months ☐
Six months ☐
A year or more ☐

2. If kept, how often do you refer back to issues of YOUR COMMODORE?

Once a week or more ☐
About once a month ☐
Once every three months ☐
Less often ☐
Never ☐

3. How long do you spend reading your copy of YOUR COMMODORE?

Over 2 hours ☐
1½ - 2 hours ☐
1 - 1½ hours ☐
½ - 1 hour ☐
Less than ½ hour ☐

4. How long have you been a YOUR COMMODORE reader?

Less than 3 months ☐
3 - 6 months ☐
7 - 12 months ☐
1 - 2 years ☐
2 - 4 years ☐

5. How often do you buy YOUR COMMODORE?

Occasional issues ☐
Most issues ☐
Every issue ☐

6. How much of YOUR COMMODORE do you read?

Read only some articles ☐
Read most articles ☐
Read all articles ☐

7. With regard to the advertisements in YOUR COMMODORE do you?

Read or look though most or nearly all the ads ☐
Read or look through some of the ads ☐
Just read or look through the occasional ad ☐
Very rarely/never look at the ads ☐

8. Which of the following would you most like to see featured with the magazine (please tick one box only)?

Cover mounted gifts ☐
Additional supplements ☐
Competitions ☐
Money saving offers ☐

9. Does anyone else read your copy of YOUR COMMODORE?

No, only myself ☐
One or two other people ☐
Three or four other people ☐
More than four other people ☐

10. If your copy of YOUR COMMODORE is read by other people, please give details of their age and sex:

	PERSON 1	PERSON 2	PERSON 3	PERSON 4
AGE: 9-14 YRS	☐	☐	☐	☐
15-24 YRS	☐	☐	☐	☐
25-34 YRS	☐	☐	☐	☐
35-44 YRS	☐	☐	☐	☐
45-54 YRS	☐	☐	☐	☐
55-64 YRS	☐	☐	☐	☐
OVER 64 YRS	☐	☐	☐	☐
SEX: Male	☐	☐	☐	☐
Female	☐	☐	☐	☐

11. With respect to the articles in YOUR COMMODORE, how do you rate the following:

	POOR	AVERAGE	GOOD	EXCELLENT
News	☐	☐	☐	☐
General features	☐	☐	☐	☐
Technical/ programming feats	☐	☐	☐	☐
Business features	☐	☐	☐	☐
Utility & hardware reviews	☐	☐	☐	☐
Book reviews	☐	☐	☐	☐
Business & educational reviews	☐	☐	☐	☐
Competitions	☐	☐	☐	☐
Letters page	☐	☐	☐	☐
Games listings	☐	☐	☐	☐
Serious/utility listings	☐	☐	☐	☐
Amiga coverage	☐	☐	☐	☐
Readers offers/ Software for sale	☐	☐	☐	☐
Music	☐	☐	☐	☐

12. Thinking specifically about the advertising content, would you please rate the two main types of advertisement:

	Display	Classified			
Very useful	☐	☐	Not very useful	☐	☐
Useful	☐	☐	Not at all useful	☐	☐
Quite useful	☐	☐			

13. Would you like to see more or less coverage given to the following:

	MORE	LESS	SAME
News	☐	☐	☐
General features	☐	☐	☐
Technical/ programming feats	☐	☐	☐
Business features	☐	☐	☐
Utility & hardware reviews	☐	☐	☐
Book reviews	☐	☐	☐
Business & Educational reviews	☐	☐	☐
Competitions	☐	☐	☐
Letters page	☐	☐	☐
Games listings	☐	☐	☐
Serious/ utility listings	☐	☐	☐
Amiga coverage	☐	☐	☐
Readers offers/ Software for sale	☐	☐	☐
Music	☐	☐	☐

14. Which other computer magazines do you read and how often?

	NEVER READ	READ OCCASIONALLY	READ REGULARLY
Commodore	☐	☐	☐
Computing Int.	☐	☐	☐
Commodore User	☐	☐	☐
Zzap! 64	☐	☐	☐
Amiga User Int.	☐	☐	☐
Amiga Computing	☐	☐	☐
Your Amiga	☐	☐	☐
Amiga World	☐	☐	☐
Popular Computing Weekly	☐	☐	☐
Personal Computer World	☐	☐	☐
Commodore Disk User	☐	☐	☐

15. If read, how do they compare with YOUR COMMODORE?

	NOT AS GOOD AS Y.C.	AS GOOD AS Y.C	BETTER THAN Y.C.
Commodore	☐	☐	☐
Computing Int.	☐	☐	☐
Commodore User	☐	☐	☐
Zzap! 64	☐	☐	☐
Amiga User Int.	☐	☐	☐
Amiga Computing	☐	☐	☐
Your Amiga	☐	☐	☐
Amiga World	☐	☐	☐
Popular Computing Weekly	☐	☐	☐
Personal Computer World	☐	☐	☐
Commodore Disk User	☐	☐	☐

16. Please give any further comments or criticisms that you feel will help us improve YOUR COMMODORE.

....

....

17. How much do you normally spend in a 12-month period on the following types of software? (please tick one box on any line)

	Nothing	£50	£51-100	£101-200	£201-300	£300+
Games	☐	☐	☐	☐	☐	☐
Business	☐	☐	☐	☐	☐	☐
Educational	☐	☐	☐	☐	☐	☐
Graphics/Music	☐	☐	☐	☐	☐	☐
Utilities/Language	☐	☐	☐	☐	☐	☐

18. What sort of listings do you type in?

	All	Some	None
Games	☐	☐	☐
Utilities	☐	☐	☐
Music	☐	☐	☐
Business (WP, Spreadsheet, etc)	☐	☐	☐

19. How much of the time do you use your computer for the followi purposes? (please tick one box on each line):

	All the time	More than half the time	Sometimes	N
Writing programmes	☐	☐	☐	
Typing in games listings	☐	☐	☐	
Typing in utility listings	☐	☐	☐	
Playing games	☐	☐	☐	
Graphics or music	☐	☐	☐	
Educational	☐	☐	☐	
Business	☐	☐	☐	
(wordprocessing, data-base, etc)	☐	☐	☐	

20(a). Have you used the YOUR COMMODORE software service?

Yes (please answer part c) ☐
No (please answer part b) ☐

(b) IF YOU HAVEN'T USED IT, why not?

Too expensive ☐
Limited Choice ☐
Delivery period too long ☐
Other reason – (please state)

....

(c) IF YOU HAVE USED IT, have you been satisfied with the software and the service you have received?

Yes ☐ No ☐

21. Put a tick next to the magazine you think offers the best coverage of the following areas (YC=Your Commodore, CCI=Commodore Computing International, CU=Commodore User, Z64=Zzapp! 64 CDU=Commodore Disk User).

(a) News
YC ☐
CCI ☐
CU ☐
Z64 ☐
CDU ☐

(b) General features
YC ☐
CCI ☐
CU ☐
Z64 ☐
CDU ☐

(c) Technical features and reviews of utilities and hardware
YC ☐
CCI ☐
CU ☐
Z64 ☐
CDU ☐

(d) Games features
YC ☐
CCI ☐
CU ☐
Z64 ☐
CDU ☐

(e) 'Serious' computing (word-processing, personal finance, art etc.)
YC ☐
CCI ☐
CU ☐
Z64 ☐
CDU ☐

22. Do computers or a related activity provide you with an income?

Yes ☐ No ☐

23. Do you attend computer exhibitions/shows?

Yes ☐ No ☐

24. If your answer to the previous question is YES, please specify which ones.

....

....

....

25. (a). Which computer(s) do you own?

C16 ☐
Plus/4 ☐
C64/64C ☐
C128/128D ☐
Amiga ☐
Spectrum ☐
Amstrad CPC ☐
Amstrad PCW ☐
IBM PC or clone ☐
BBC ☐
Electron ☐
Atari ST ☐
Other Atari ☐
Other (please specify) ☐

....

(b) How long have you had a Commodore computer?

Less than 3 months ☐
3 to 6 months ☐
7-12 months ☐
1-2 years ☐
Over 2 years ☐

26(a). Do you own a disk drive that you use with your Commodore computer?

Yes ☐ No ☐

If 'Yes' please answer the next part.

(b) What make/model is your disk drive?

1541 ☐
1551 ☐
1570 ☐
1571 ☐
Other made by Commodore ☐
Other not made by Commodore ☐

27(a). Do you own a printer that you use with your Commodore computer?

Yes ☐ No ☐

If 'Yes' please answer the next part.

(b) What type of printer is it?

Commodore ☐
Epson Compatible ☐
Other ☐

28.(a) Do you think you are likely to buy a new computer during the next year?

Yes ☐ No ☐

(b) If 'Yes', which do you think you are likely to buy?

C128/D ☐
Amiga ☐
IBM PC or clone ☐
Atari ST ☐
Other (please specify) ☐

....

....

29. Which of the following types of software do you own and use:

Word-processor ☐
Data-base ☐
Spreadsheet ☐
Assembler ☐
'Art' package ☐
Music package ☐
Games ☐

30. Do software reviews influence your buying?

Yes ☐ No ☐

31. Do software charts influence your buying?

Yes ☐ No ☐

32/ Are you aware of the scheduled publication day?

Yes ☐ No ☐

33. If the answer to the previous question is YES, do you attempt to purchase the magazine on that day?

Yes ☐ No ☐

34. How do you normally obtain your copy?

Chance purchase ☐
Newsagent shop collection ☐
Newsagent home delivery ☐
Subscription ☐
Passed on copy ☐

35. If you are a subscriber, on which date did you receive this issue?

☐☐/☐☐/☐☐

36. If you are a subscriber, how long have you subscribed to this magazine?

1-6 months ☐
7-12 months ☐
1-2 years ☐
3-4 years ☐

37. If you do not obtain your copy by subscription, is it due to one of the following:

Subscription too expensive ☐
Not every issue required ☐
Not aware subscription service available ☐

38. Are you aware that to subscribe to this magazine in the U.K. is the same cost as purchasing it in a shop?

Yes ☐ No ☐

39. Would you like to receive further details on taking a subscription?

Yes ☐ No ☐

40. If you do not subscribe, from which type of newsagent do you most often obtain your copy?

High Street shop ☐
Estate shop ☐
Corner Shop ☐
Travel Point ☐
Other (please specify) ☐

....

41. If you have subscribed to this magazine but now lapsed, is it due to:

Subscription too expensive ☐
Every issue no longer required ☐
Lateness in receiving subscription copy. ☐
Poor service from our subscription bureau ☐

42. What is your marital status?

Married ☐
Single ☐
Divorced ☐

43. Age (please tick)

Under 15 Yrs ☐
15-18 Yrs ☐
19-21 Yrs ☐
22-24 Yrs ☐
25-34 Yrs ☐
35-44 Yrs ☐
45-54 Yrs ☐
55-64 Yrs ☐
Over 64 Yrs ☐

44. Sex:

Male ☐ Female ☐

45. Are you.....?

In full-time employment ☐
In part-time employment ☐
Not employed at present ☐
Retired ☐
Student – full-time ☐
Student – part-time ☐

46. If in full-time employment, please state your occupation:

....

47. If student, what subjects studied?

....

....

48. Please tick the box which represents the annual total of your gross income:

Under £6,500 ☐
£6,501-£8,000 ☐
£8,001-£10,000 ☐
£10,001-£12,500 ☐
£12,501-£15,000 ☐
£15,001-£19,000 ☐
£19,001-£25,000 ☐
Over £25,000 ☐

49. Which of the following do you have?

Bank current account ☐
Bank deposit or savings account ☐
Life assurance policy ☐
Any stocks or shares ☐
Access card ☐
Barclaycard (Visa) ☐
American Express ☐
Diners Club ☐
Unit Trusts ☐
Private medical ins. ☐
Personal Accountant ☐
Building Society account ☐
A mortgage ☐
Any H.P. agreements ☐
Telephone ☐

50. Do you own your home, rent or live with your parents?

Own ☐
Rent ☐
Live with parents ☐
Other (please specify) ☐

....

51. If you own your own home, what is the approximate value (your principal residence if you have more than one)?

Under £50,000 ☐
£50,000-£74,999 ☐
£75,000-£99,999 ☐
£100,000-£149,999 ☐
£150,000-£200,000 ☐
Over £200,000 ☐

52. How many rooms does your home (or principal residence) have?

	1	2	3	4	5	6
Bedrooms	☐	☐	☐	☐	☐	☐
Reception rooms	☐	☐	☐	☐	☐	☐

53. If you have children, please indicate their age and sex (give details of the four youngest if you have more than four.)

		FIRST	SECOND	THIRD	FOURTH
AGE:	1-3 yrs	☐	☐	☐	☐
	4-8 yrs	☐	☐	☐	☐
	9-12 yrs	☐	☐	☐	☐
	13-16 yrs	☐	☐	☐	☐
	Over 16 yrs	☐	☐	☐	☐
SEX:	Male	☐	☐	☐	☐
	Female	☐	☐	☐	☐

54. How many of the following items do you buy, on average, over a month?

	LESS THAN 1 PER MONTH	1 or 2	3 or 4	5 or 6	MORE	NEVER BUY
A book	☐	☐	☐	☐	☐	☐
A record	☐	☐	☐	☐	☐	☐
A tape	☐	☐	☐	☐	☐	☐

55. Please indicate below when you last did any of the following:

	IN LAST WEEK	IN LAST MONTH	LONGER AGO
Ate out at a Restaurant	☐	☐	☐
Entertained at home	☐	☐	☐
Went to the theatre/opera/ballet	☐	☐	☐
Went to a music concert	☐	☐	☐
Went to the cinema	☐	☐	☐
Attended at sporting event	☐	☐	☐
Visited an art gallery/museum	☐	☐	☐
Went to a pub	☐	☐	☐
Had a short break in a hotel.	☐	☐	☐
Overseas holiday (in last 12 months.)	Yes ☐	No ☐	

56. Which of the following do you drink?

	MORE THAN ONCE A WEEK	ONCE A WEEK	LESS OFTEN
Beer	☐	☐	☐
Lager	☐	☐	☐
Wine	☐	☐	☐
Sherry	☐	☐	☐
Port	☐	☐	☐
Brandy	☐	☐	☐
Gin	☐	☐	☐
Rum	☐	☐	☐
Vodka	☐	☐	☐
Whisky	☐	☐	☐
Liqueurs	☐	☐	☐

DON'T DRINK ☐

57. Where do you buy most of your drink from?

An Off-licence ☐
A supermarket ☐
A Public House ☐
Other (please spcify) ☐

....

58. Do you have any of the following cards either yourself or jointly with another person?

Cash dispenser card ☐
Retailer card/store card ☐

59. Name the three television programmes you watch most regularly

....

....

....

60. Do you listen to commercial radio stations?

Yes ☐ No ☐

61. How many cars are there in your household?

- None ☐
- One ☐
- Two ☐
- Three or more ☐

62. What cars do you own?

....

....

63. Is one or more of your cars a company vehicle?

Yes ☐ No ☐

64. Do you usually buy your cars new?

Yes ☐ No ☐

65. How often do you tend to change your car(s)?

- Once a year or more often ☐
- About every two years ☐
- About every three years ☐
- Less often ☐

66. Do you smoke?

- Cigarettes ☐
- Cigars ☐
- Pipe ☐
- Don't smoke ☐

67. Other than items purchased for your computing, have you bought any other types of goods by mail-order during the past 12 months.?

Yes ☐ No ☐

68. If the answer to the previous question is YES, please state the type(s) of goods purchasesd.

....

....

69. Which of the following newspapers do you read?

- The Times ☐
- The Daily Telegraph ☐
- The Financial Times ☐
- The Guardian ☐
- The Independent ☐
- The Daily Express ☐
- The Daily Mail ☐
- The Daily Mirror ☐
- The Sun ☐
- Today ☐
- None of the above ☐

70. Which of the following Sunday newspapers do you read?

- The Sunday Times ☐
- The Observer ☐
- The Sunday Telegraph ☐
- The Sunday Express ☐
- The Mail on Sunday ☐
- The Sunday Mirror ☐
- The People ☐
- The News of the World ☐
- News on Sunday ☐
- None of the above ☐

71. Are you a member of a book club?

Yes ☐ No ☐

72. Are you a member of a record club?

Yes ☐ No ☐

73. Which, if any, of these sports and activities do you play or take part in nowadays?

- Cricket ☐
- Fishing ☐
- Golf ☐
- Rugby ☐
- Soccer ☐
- Sailing ☐
- Skiing ☐
- Shooting ☐
- Swimming ☐
- Squash ☐
- Tennis ☐
- Weight training ☐
- Windsurfing ☐

74. Which of the stores listed below have you been shopping in during the last six months?

- Boots ☐
- W.H. Smith ☐
- John Menzies ☐
- Dixons ☐
- Currys ☐
- Laskys ☐
- Rumbelows ☐
- Burtons ☐
- Austin Reed ☐
- Hornes ☐
- Next ☐
- Fosters ☐

75. Do you own a:

- Stereo/Hi-Fi system ☐
- Tape player/recorder ☐
- Video recorder ☐
- T.V. ☐
- None of the above ☐

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....

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Grey/Black/Yellow Jacket	50H106HB3		£32.99		
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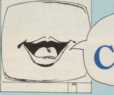

Talking Computers

How to program a mini Max Headroom into your favourite program

It's all very well being able to hear your prose spoken by a disembodied voice through a voice synthesiser. How much better it would be to see who the voice belonged to.

Creating a simple face on the screen is easy; getting it to talk is a touch more difficult. Even the creators of the television presenter, Max Headroom, had to rely on an actor made-up to look as though he was computer generated and enhanced by a few clever TV tricks. Armed only with some speech software, the odd sprite and a C64, I considered the possibilities of creating a talking head!

It seemed like a good idea because a talking head in an adventure would allow the users to not only see the guide but it would also tell them what was going on; a game show host could read out the questions and answers; cartoon characters designed by you, working in your own programs could be seen and heard to speak just like Fred Flintstone or Yogi Bear. Imagine your own program being introduced by a talking head explaining how to use the program...it's easy to get carried away by the possibilities but what about the practical problems?

The key to your character being seen to talk is lipsync. Lipsync means that the speaker's lips move precisely at the same time as each syllable is spoken. If the timing of these two events is not perfect then the results will look very strange. A character in the distance can be seen simply to open and close its mouth but at closer quarters this technique looks rather bad. It can be disguised by large movements of the head as in the TV program 'Spitting Image' and with ventriloquists' dolls, but those who remember the TV series, 'Thunderbirds', will recall how unconvincing the puppet's speech was because of too limited lipsync and simplistic mouth movement.

Cartoon animators recognised this problem as soon as they started adding speech to their characters and devised a number of lip movments for saying different letters. For example, the letters B and P are spoken with the lips closed and then immediately opened as they are pronounced. Similarly, the letter O requires the lips to form a different shape and so on. The problem's not getting easier is it! Fortunately such lip movements can be reduced to just a few key 'frames' to produce a reasonably convincing result.

Blinking nuisance

To add to the realism, as the lips of your character move, you should also be able to see other facial movements. The eyelids blinking or the eyes moving from side to side add realism but also create more problems.

Sprites are the ideal solution for displaying both lip and eye movement. In creating the lip movements, its possible to use just five mouth shapes to provide an acceptable result. This may not be adequate for lip-readers but it does give a convincing display. To narrow down the range of movements, I have taken groups of letters that use similar lip movements and grouped them together. The letters U,Y,W use basically the same mouth shapes but F and V share their own particular mouth shape. When the character is speaking the movements will have to blend with each other in a fairly natural way.

To achieve a convincing blink, it's important to realise that a blink is performed unconciously and at random. The program can't rely on a set delay and must therefore look to some other form of control to give a realistic result. I could have chosen to use the random number generator in the computer but it seemed a neater idea to control the blink through the string of characters to be spoken. Taking advantage of the random occurrence of the letters within a sentence, I selected the letter 'O' to cue the blink. So every time the program reads an 'O' the character will blink.

The Lipsync program that accompanies this article works by reading a string and, by scanning each character in turn, instructs a predefined sprite to be printed accordingly.

Controlling the delay is critical to lipsync but the speech synthesiser transfers a string to its own buffer and speaks as it reads each character from this buffer. The actual speech slows down the emptying of the buffer to its own slower speed as it calculates which sound goes with which character and this also makes it sound more realistic. If it didn't do this, the buffer would empty in a fraction of a second.

Because of this inbuilt sluggishness, the interrupt-driven speech software frees the computer to get on with another task, in this case reading the string for the Lipsync program. At this point I should mention that the speech buffer should always be filled just prior to the SYS call for the Lipsync routine.

The Talking Head listing is sprite data made up with four individual sprites to produce a talking head for use with Lipsync. Run the Talking Head Demo to see it in operation.

Only the first four sprite pointers are used for the head leaving the other sprites for you to use for the body or whatever else may be required. The talking head could be used in various applications including games. The beauty of only using sprites for the head is that any text printed on the screen can scroll up without affecting the positioning of the head. Feel free to redesign the head with a sprite editor but be careful not to alter the mouth shapes too much because they must relate to the characters read from the strings.

The final program Monster Talks, is a complete program controlled from Basic. Persons of a nervous disposition should not copy this listing.

Getting it all in

Type in the BASIC loader in the normal manner. When the checksum adds up correctly, it will save it self as LIPSYNC MC, so make sure you're prepared.

Lipsync is called by SYS49333, SPRITE LOC, TIME DELAY, STRING.

SPRITE LOC is the first byte of the current sprite location. This permits you to store your talking head sprites in any location which is more convenient for your own programs. The TIME DELAY controls the lipsync timing. The STRING is where the Lipsync program finds which string to read. This can either be a string of characters in quotes or a string variable. The Lipsync Demo should be a guide and you can adapt it to your own needs in the future.

Talking Head

The loader program consists of sprite data and again will save automatically if the data has been typed incorrectly. Talking Head is for use with Lipsync only and should not be used in conjunction with the next program. Make sure that you have the Lipsync programs following on in the correct order if you're using tape, or that they are on the same disk if you're not. Sprites parameters such as positioning, size, etc. are controlled from Basic. (See Lipsync Demo.) The talking head sprites are located in memory at $3C80 (15488).

Monster Talks

Type and save Monster Talks Ldr. Before you run it, reset the computer and type in the following in direct mode (if you don't do this the Basic loader will corrupt itself).

```
POKE43,0:POKE44,32:POKE
40959,0:NEW
```

As with the other programs, it's best to study the demo and experiment for yourself. The program Monster Talks resides at the start of Basic so as to avoid any memory conflicts with any of the speech software.

Once saved as a working program, the program should be run before using, or writing, a Basic program. The reason being that it raises the start of Basic to protect itself from being over written.

Controlling Monster Talks

When you have loaded Monster Talks, run it before loading the demos or entering your own programs. SYS 3650 will initialise and print the Monster onto the screen.

```
SYS 3650+3, TIME DELAY,
STRING.
```

Will co-ordinate the lipsync after any call to your voice synthesiser.

SYS 3650+6 will return you to Basic.

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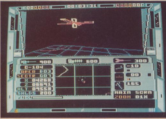

Echelon

Your orders are to report to the top secret flight facility known as Echelon and be trained to operate the Lockhead C-104 Tomahawk which is the most awesome combat and exploration craft in the 21st Century. So begins this 3D spaceflight simulator, from the authors of Leaderboard.

This task shouldn't be any problem to someone who's mastered the controls of a 20th Century craft such as a Gunship helicopter or a civil or military aircraft because you have standard controls over the craft's pitch and roll, thrust and attitude. In fact the game comes with a Gunship-style keyboard overlay to help you find the right keys without delving continually into the extensive 72 page instruction manual.

Squeezed inside the presentation box is a lipstick, which sets Echelon apart from other combat flight simulators. No, it's not the latest shade from Max Factor but a voice-activated, headset microphone (lipstick) which you use to fire your weapon systems. It's important to realise that it's only voice-activated and does not employ voice recognition, it simply waits for some noise to activate it. In other words saying FIRE will launch a missile, as will LAUNCH, WOMBAT, or a whistle or cough. The headphones supplied with the Lipstick don't actually work but *do* create an interesting atmosphere.

With your headset on and your joystick primed you're ready for action. After a brief security check to make sure the Lipstick and joystick are in the correct joystick ports, the main game loads and you are launched into the massive vector graphics landscape. A grid that corresponds to your map references is superimposed on the ground to help you navigate around the various sectors as you carry out one of three missions.

In scientific mode, your job is to explore the planet, collect and identify curious objects and solve a series of mysteries to unearth what exactly is going on in this sector and what, if anything, is the significance of the pirate maps. I'm not giving anything else away about this mission as it's the main one in the game but it will suit those gamers who prefer a logical approach which engages their minds more than their lasers.

Patrol mode adds some action for itchy fingered combat pilots while they're exploring the unknown and Military mode is all-combat for those who want to try out their missiles, lasers and photon cannons. These are selected by pressing the function keys and then fired using the Lipstick.

As a combat game, Echelon quickly reached a limit where hurling missiles at only one type of alien became tiresome and so I decided to concentrate on the scientific mission and began exploring the unknown. In this mode you can hover and land or even launch the RPV and remote vehicle from which you can watch the Tomahawk itself to get a different angle on the action.

The game now comes into it's own as you find a massive playing area to explore which includes buildings satellites and towers, some of which hold the keys that could unlock the mystery of the private maps.

T.H.

Touchline:
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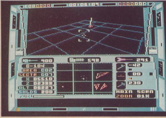

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The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

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OCTOBER 1988

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Letters

Your opinions are what count. So put pen to paper and let us know how you feel about the industry, and of course the magazine!

I would like to pass on some criticism of *Your Commodore* magazine. The broad coverage of your magazine serves the interests of many readers known to me. The odd printing error or so is no problem and is usually remedied on the Back Page.

Our complaint would only be the poor presentation of some programmes. A recent example is the C64 Utilities Unlimited series. The February program Turbo Menu Maker was very hard to read and I found several cases where "66" entered produced the same checksum as "55". However, after borrowing the magazines of fellow readers most of the errors were resolved. The program runs but I'm sure it still has an error or two.

The March issue continued the series with three more potentially useful utilities. The second program however, proved impossible to read in certain sections. After borrowing magazines from friends again, buying a second copy from a different newsagent (I tried to get away from my neswagent's obviously bad batch); and then being loaned a copy from my original newsagent the program still remains unfinished. I have even resorted to making blown-up copies of the unreadable parts on a copier and still failed.

Given the high quality of other program formats used in *Your Commodore* e.g. Popper and Spelling Checker along with Joystick Read in the same issue, supporters of Your Commodore should be able to enjoy the same high quality presentation in all program presentations.

On another topic, your review Write On (Nov '86) re: Script/Plus for Plus/4 and C16 owners was glowing in its praise. I subsequently obtained this program and am using it for this letter. It is much more convenient than Easy Script on the C64, however I wonder if English versions have the same problems with two minor bugs in the program acknowledged by Commodore in Australia. One, Save with Replace?, does not work, a new file name has to be used, Two, it is necessary to exit Disk Mode and return again to execute a second disk command.

Thank you for a well-balanced magazine, for all Commodore owners including Plus/4 and C16, forgotten by lesser magazines.

G.K. Polson, Australia.

In the next few months you should be seeing a marked difference in the listings of Your Commodore. *We will be starting to print many of our programmes using lower case. This will avoid confusion between certain letters and numbers, for example 8 and B.*

The 'poor presentation' that you mention in your letter was due to a grey tint being placed behind the listings. Steps have already been taken to prevent this happening again.

We have already mentioned in the magazine that 'clean' photocopies of the DISKIT series (1-5) are available from this office. If anyone would like a copy then send a large stamped, self-addressed envelope to:

DISKIT PHOTOCOPIES
Your Commodore
1 Golden Square
London
WIR 3AB

As for your question about Script Plus, we have not experienced this problem. Maybe some of our readers have?

Calling all knitters

I have been using and following Commodore for nearly two years, and reading *Your Commodore* for a year and really enjoy the coverage given to all aspects of computing. But I have one moan at the moment, and this is that there is a Sinclair and an Amstrad program for knitting, but there is nothing from Commodore programmers. My wife enjoys knitting and would like to see a program for knitting as I'm sure would the many wives of other male computer maniacs.

Is there any one that has an idea about such a program? Or perhaps one of the programmers from *Your Commodore* can put together a program for knitting.

I can even understand the fact that there is practically no programmes for the C128 (of which I own and am proud off) and it is the same with some utility programmes; there seems to be more for BBC computers and Amstrad, etc, than there is for Commodore? It is not as if the Commodore does not have the capabilities for such programmes, the blame lies with the programmers who keep pumping out games and don't give us the chance to use and

appreciate and enjoy some different utility programmes.
Norman Stone, Chelmsford, Essex.

Knitting and computing don't normally go hand in hand and I'm afraid that I don't know any knitting computer buffs who could produce such a program.

I'm sure that one of our readers somewhere will have, or could, produce such a program. So come on send it in, we may even publish it!

Cutting down the Workload

As a small businessman now getting to grips with computing I would like to express my thanks to you for publishing a magazine that covers the whole field of Commodore computing.

Many of your article/programs have helped me now to make computing profitable and labour saving, by showing me how to write my own detailed programs in Basic that get the desired results in half the time required by a certain well-known make of PC and clones.

Might I hope that in the not too distant future as the 128 becomes more established, we shall see some programmes to make greater use of its ability to read other formats and thereby saving hundreds of poor overworked users the never ending problems of incompatible disks.

Having over the years had a great deal of experience with many makes of so called business computers, I have come to appreciate that instructions to employees can in fact be written directly into a computer in Basic and be carried through, without further help from any human hand. The speed at which the computer works is of little importance if there is not the need for an operator to sit watching it. What is important is be able to communicate with your computer in a way that it understands. Your magazine articles and programmes about Basic help tp show how simple it is to communicate and programmes about Basic help to powerful and reliable employee in its own right. It also shows that a businessman can still be the boss and need not be the slave to the computer and its software.

During the past four years I have been able to increase my clientele and profits and have more spare time and I owe all this to two very important factors. Firstly my good fortune to finally purchase a Commodore computer and secondly to reading *Your Commodore* every month.
Mike Gray, Leatherhead, Surrey.

Making Music?

I am a musician interested in the musical possibilities of computers and I have been struggling with my 64 for sometime, so I was pleased to see the inclusion of a new series on music in the August issue.

However, I was disappointed after reading the article by Peter Gerrard. The article is supposed to be an introduction but I found it irritating that a couple of errors were made that would either confuse or baffle a newcomer.

Firstly terminology: the term waveform was confused with the term wavelength, waveform refers to the shape of the sound wave i.e. triangular, sawtooth, etc. Wavelength is the length of one complete cycle of the wave, i.e. from one peek of the wave to next. Physicists will know that wavelength is measured in metres like the dial on your radio and is inversely proportional to the frequency.

Finally the few lines of the program between the text which is supposed to make a sound will not work, because a value of zero is in the SID registers (54272 & 54273) that control the frequency. The first line of the program clears the SID chip by poking zeros into all the registers. A paragraph explaining the frequency control registers should have been included in this introductory article, after all if this was your first attempt at a sound program on the 64 you could have been put off for life.

For readers who are still in need of a little help I can recommend Ian Waugh's book Music for Commodore 64 (Sunshine Press).

Despite the fact I am complaining, I think *Your Commodore* magazine is probably the best Commodore computing magazine around at the moment. There have been numerous useful utility programmes for the serious user so I am looking forward to more music articles in the future particularly interrupt driven music routines.
V.H. Berry, London.

We've had many letters praising Pete Gerrard's attempt at clarifying the quagmire of programming the Commodore sound chip.

Thanks, for pointing out the errors, anyway. Be assured that Pete has had his hands slapped.

As for interrupt music routines, these will be covered in a later part of Pete's series.

I wish to take this opportunity to congratulate you on your marvellous publication *Your Commodore*. I have purchased every edition and have found it extremely helpful. My previous computer was a 64 and I now own a 128. Therein lies the problem.

The really excellent utilities published, it seems to me, are for the most part aimed at 64 users. WIMP is an example of this. I hope that future issues will include 128 Utilities similar to WIMP.

Also your articles mention references to future articles, eg. single pixel hi-res smooth scrolling "à la Crowther". As I am obsessed with scrolling, I buy each issue in anticipation that this will be the one containing smooth scrolling, only to be disappointed. These future articles never seem to materialise. I hope some consideration might be given to continuity of a series.
Michael Vocale, Australia.

Many thanks for your kind comments about the magazine.

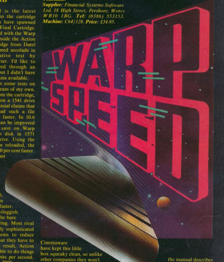
I'm sorry that you feel that most of our programmes are for the C64 and not the C128. Don't forget that all C64 programmes should work on the C128.

Obviously since most Commodore owners have a C64 the large majority of the submissions are for this machine. So come on you owners of other Commodore computers, send your programmes/articles in to us.

Sometimes authors of articles do promise us second, and even third parts, which unfortunately don't always materialise in our office; sometimes due to pressures of work. Even so, we do always try to bring you as many articles on programming as we can. Maybe this letter will provoke Mr Crowther into producing some new prose/programs for our readers to mull over.

By Gordon Davis

Touchline:
Supplier: *Financial Systems Software Ltd, 18 High Street, Pershore, Worcs WR10 1BG.* ***Tel:*** *(0386) 553153.*
Machine: *C64/128.* ***Price:*** *£34.95.*



Warp Speed is the latest contender in the cartridge wars which have spawned the Expert and the Final Cartridge. It's not to be confused with the Warp 25 fast load system inside the Action Replay Mk IV cartridge from Datel which received the speed accolade in a recent comparative test by Commodore Disk User. I'd like to have put Warp Speed through an identical procedure, but I didn't have the precise test programs available.

I did however run some tests on a 47-block Basic program of my own. With no assistance from the cartridge, this program loaded on a 1541 drive in 35 seconds. The manual claims that Warp Speed can load such a file roughly 500 per cent faster. In 10.6 per cent faster. This can be improved on because the fast save on Warp Speed writes files to disk in 1571 format on a 1541 drive. Using the cartridge these can be reloaded, the manual says, up to 1000 per cent faster.

When tested, the fast save itself took just over seven seconds, while reloading took six seconds in this format. That's not 1000 per cent, more like 600, but to be fair, the claim is *up to* 1000 per cent faster. Frankly, this is rather sluggish. Warp Speed is doing the bare minimum of fast loading. Most rival cartridges use relatively sophisticated crunch/decrunch systems to reduce the number of byes that they have to read and write. As a result, Action Replay's Warp 25 is able to do things at an incredible 35.6 bits per second. That's approximately 2000 per cent faster.

Warp Speed at its fastest is loading at about 10 bps (as against 1.8 bps for a naked system) which makes it comparable with the Freeze Machine in its slowest mode. Since this latter was the slowest loader during the cartridge speed trials, Warp Speed's performance is not good.

Clean cut

Perhaps Warp Speed has other good points? Well if you're on the lookout for a cartridge that does naughty things don't look at this one. You can't grab anything, freeze it or twiddle with it in any way.

Cinemaware have kept this little box squeaky clean, so unlike other companies they won't be getting slapped wrists from the software houses.

All this makes Warp Speed a little worthy-but-dull. Nonetheless it does have useful features. Disk or file copy and multi-scratch commands are included, plus a very respectable sector editor and an extensive range of utility commands.

There's also a built-in machine code monitor. Cinemaware says 'one of the most advanced monitors ever produced for the Commodore 64 and 128.' Could've fooled me! I must be missing some little thing or other, because to me it looks just like a monitor, neither better nor worse than a host of other monitors. Worse, the manual describes it as a monitor/assembler. An incredible achievement because what we have here is an assembler with one command! In fact what it does is to take a mnemonic and operand in immediate mode and convert them to machine code, that's all. Useless for entering more than about 8 bytes of code, and not even that if you need to branch. Hype, do they mean us?

All things considered, the most useful thing about Warp Speed is that it has a little switch which enables it to work in either C128 or C64 mode. Apart from that it's a rather dull, pedestrian product far surpassed by other cartridges on the market.

Disk Contents

How is information stored on a disk and where does GCR come in? **By Eric Doyle**

Commodore disk drives are classed as 'intelligent' drives because they contain their own disk operating system (DOS) which maximises on the amount of free space for programming within the computer's memory. All of the operations are translated and executed by the 6502 based circuitry inside the drive making it effectively a dedicated computer in itself. Contained on the board is a 16K ROM operating system and 2K of RAM for temporary storage of information for transmission to the computer (buffers) and for variables generated by the 6502.

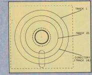


Diagram 1: *Track arrangement on 5.25 disk*

Information is stored on disk in short bursts of data (sectors) which are arranged around the disk in concentric rings known as tracks. There are 35 tracks across the disk surface but the number of sectors varies with the circumferal length of the track. Obviously the track around the centre of the disk is shorter than the first track around its rim. On most other disk systems the number of sectors is the same on each track but the concept of the Commodore system is one of effective use of storage space. Where other systems leave large tracts of wasted space on the outer tracks, the 1541 system packs in extra sectors and increases the disk capacity.

Table 1 — Tracks and Sectors

TRACK NUMBERS	SECTORS	TOTAL
1-17	21	357
18	19 (directory)	19
19-24	19	114
25-30	18	108
31-35	17	85

Total number of sectors = 683
Number of usable sectors = 664

Most people know that each sector stores around 256 bytes of information but the data is not stored in the usual binary or hexadecimal format. A system known as Group Coded Recording (GCR) is used which displays certain features that enable the storage system to be even more compact than would be possible otherwise. GCR is an unambiguous system which reduces the number of extra data bytes required by most other storage systems.

GCR is based on binary bits in groups of five (extended nybbles) arranged in such a way that no consecutive bytes will result in a series of eight ones or eight zeros. The reason for this will soon become clear but first the GCR system must be explained.

To convert from eight binary to five bit GCR, the binary byte is split into two four bit nybbles. For example the number 158 is represented in binary by 1001 1110. Taking each nybble in turn, Table 2 shows that these convert to 11001 and 11110. Information is still stored on the disk in eight bit bytes so the GCR value becomes a full byte of 1100111 and the top three bits of the next byte is formed by 110 and the first five bytes of the next GCR converted nybble.

Sector Dissection

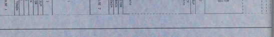
A sector consists of an eight part header section, a fixed length gap, a seven part data section followed by another gap which leads to the next sector as shown in Table 2.

The first section of the sector consists of a synchronisation mark consisting of five bytes of value 255 which is immediately followed by a byte of value 8. The second section of the sector starts with an identical sync mark but this is followed by a value of seven. This means that when the head detects a 255 byte the operating system is alerted to the fact that some important information will follow. The next byte, the designation byte, indicates whether it is a data (7) or a header block (8).

On a header block the designation byte is followed by the two ID bytes specified in the formatting formula NO:DISKNAME,ID. This is why it is important to vary the ID from one disk to another.

The next two values pinpoint the actual track and sector values and finally a checksum byte is included as

Diagram 2: *Sector information storage*



an error check. The checksum is derived by applying the EOR command to the track, sector and two ID values in turn.

When converted to GCR the block count does not equal a whole number so a pad of two coverted bytes (20 bits GCR) is used to give a total header block of 15 full GCR bytes which converts to exactly 12 decimal bytes.

To allow time for the calculation and evaluation of the checksum, there is a short padding gap of eight bytes (10 bytes GCR).

After this gap comes the data header sync signal followed by the data designation byte (7) indicating the start of the data block. The following 320 GCR bytes convert to what we know as the 256 normal binary bytes which form the data store, the first two bytes of which are a pointer to the next track and sector of program information.

The next byte is a checksum for the data block and is followed by a block equalising padding sector of 20 GCR bits. The intersector gap follows but its length depends on which track the sector is found and the speed of the drive.

The sectoı is 355 bytes long but when converted to true decimal this becomes 284 bytes. Of this only 254 bytes are of relevance to the computer so you can see that a sector is much more complicated than you may at first think. The complexity results in a very accurate and reliable basis for the operating system to latch onto.

As you can see the five bit GCR numbers are stored in the normal eight bit format so that the sequence 144, 0, 255, 7 would convert directly from GCR to decimal as 202, 148, 170, 165, 87, five bytes instead of four.

Why is such a complicated system necessary? The disk drive can cope with conversions very easily and the avoidence of bytes of 11111111 or 00000000 means that these can be used for special purposes. To examine this in depth means a study of the format of a single sector.

Disk Organisation

As you've seen, the disk has a rigid structure of tracks and sectors which must be organised by the DOS. To do this the system claims a full track for its own exclusive use –track 18. This is not counted when the 'blocks free' value is calculated so an empty,

Table 2 – Standard Systems to GCR Conversion

DEC	HEX	BIN	GCR	DEC	HEX	BIN	GCR
0	$01	%0000	01010	8	$08	%1000	01001
1	$01	%0001	01011	9	$09	%1001	11001
2	$02	%0010	10010	10	$0A	%1010	11010
3	$03	%0011	10011	11	$0B	%1011	11011
4	$04	%0100	01110	12	$0C	%1100	01101
5	$05	%0101	01111	13	$0D	%1101	11101
6	$06	%0110	10110	14	$0E	%1110	11110
7	$07	%0111	10111	15	$0F	%1111	10101

To make this clearer we'll consider how the following four decimal bytes would be stored:

Table 3 – Decimal to Eight bit GCR Conversion

DECIMAL	BINARY nybbles	GCR EXTENDED nybbles	EIGHT BIT GCR
144	1001 0000	11001 01010	11001010/10
0	0000 0000	01010 01010	010100/1010
255	1111 1111	10101 10101	1010/110101
7	0000 0111	01010 10111	01/01010111

Table 4 – Header format

Track 18 Sector 0

BYTE	CONTENTS	DEFINITION
0	Next track	Normally value 18
1	Next sector	Normally value 4
2	Format ident	For 1541 value is 65
3	Unused	Value zero
4-143	Block allocation map	See Table 5 for details
144-161	Start of disk name	Padded with 160 values if less than 16 bytes
162-163	Disk ID	Two byte ID also uses byte
164	Shifted space	Value 160
165-166	DOS version and format type	50 and 65 for 1541
167-168	Shifted spaces	Value 160
169-179	Not used	Value zero
180-191	Message	BLOCKS FREE characters on some versions, otherwise value zero
192-255	Not used	Value zero

Table 5 – Block Allocation Map (BAM)

Track 18, Sector 0: Bytes 4-143

BYTE	CONTENTS	DEFINITION
4	Number of free blocks	Blocks free on track 1
5	Bit map of sectors 0-7	
6	Bit map of sectors 8-15	
7	Bit map of sectors 16-23	
8-143	As for 4-7	Each track in turn in groups of four

e.g. BYTE	4	5	6	7
VALUE	OF	F8	E3	FF
BIT	15 blocks free	11111000	11100011	11111111
SECTOR		7-0	15-8	23-16

1 = block free 0 = block used

formatted disk only has 664 blocks free and not 683 as you might expect.

The DOS uses sector 0 as a space to store the disk header name and ID and an area to map out which sectors have been used and which are still available. In common with every other used block on the disk, the first two bytes indicate the location of the next block in track and sector order. On the header block this is always $12 and $01 or track 18, sector 1 in decimal terms.

Track 18,1 is the first block of the directory index and each entry occupies 32 bytes. On the first file entry in a block the first two bytes (0 and 1) point to the next track and sector in the chain (usually 18,4). On all other entries the first two bytes are both zeros.

The third byte is where the directory really starts with a byte which denotes the type of file - PRG (program), SEQ (sequential), REL (relative), USR (user) or DEL (deleted).

The next two bytes are pointers to the first track and sector of the file proper, then sixteen bytes are reserved for a name and bytes 30 and 31 contain the number of blocks in the file in hexadecimal low byte, high byte order.

Relative files need a special sector or series of sectors (called side sectors) and their location is stored in bytes 21 and 22 (track and sector) and byte 23 stores the fixed record length.

The file blocks start with the usual track and sector pointer followed by data in SEQ and REL files but the PRG files reserve two bytes in the first sector for the load location in the computer's memory in hi-lo byte hex format. All the following PRG sectors resemble SEQ and REL file formats with the two pointers being followed by 254 bytes of solid program data.

This continues through the chain of blocks until the last sector in the file is reached. Here the first byte is always zero and the next byte indicates where the byte after the last byte of the file can be found so that DOS knows when to hand control back to the computer.

Going back to the side sector, this is principally a list of where each record of the file is located in track, sector format. The first two bytes will form the link to the next side sector but the record length is also included so that the DOS can calculate which sector on which track and on which byte of that sector a particular record starts.

Table 6 - **Directory Format**

BYTE	CONTENTS	DEFINITION
0	Next directory block track	Always value 18
1	Next directory block sector	Value between 2 and 18
2	File type	128 = DEL 129 = SEQ 130 = PRG 131 = USR 132 = REL
3-4	Start track and sector	First file block pointer
7-20	First filename	Padded with value 160 if less than 16 characters
21-22	Side sector track	REL files only otherwise zero
24-27	Not used	Value zero
28-29	Track and sector of	Only used when 0: save is in use replacement file
30-31	Number of file blocks	Length of file in lo-hi format
32-33	Not used	Value zero
34-63	Second file	Similar to bytes 2-31
62-95	Third file	Similar to bytes 32-63
96-127	Fourth file	Similar to bytes 32-63
128-159	Fifth file	Similar to bytes 32-63
160-191	Sixth file	Similar to bytes 32-63
192-223	Seventh file	Similar to bytes 32-63
224-255	Eight file	Similar to bytes 32-63

Table 7 - Sequential files

BYTE	CONTENTS	DEFINITION
0-1	Next track and sector	Pointer to next SEQ block
2-255	Data bytes	254 file bytes

Table 8 - Program files

BYTE	CONTENTS	DEFINITION
0-1	Next track and sector	Pointer to next PRG block
2-3	Computer load location	Only on first block otherwise data
4-255	Program data	252 bytes

Table 9 - Relative Files

Record block

BYTE	CONTENTS	DEFINITION
0-1	Next track and sector	Pointer to next record block
2-255	254 bytes of data	Empty records contain 255 in the first byte followed by zeros. Partially filled records are padded with zeros

Side sector block

BYTE	CONTENTS	DEFINITION
0-1	New track and sector	Next side sector
2	Side sector number	Value 0 to 5
3	Record length	Maximum 255
4-5	Track and sector (0)	First side sector pointer
6-7	Track and sector (1)	Second side sector pointer
8-9	Track and sector (2)	Third side sector pointer
10-11	Track and sector (3)	Fourth side sector pointer
12-13	Track and sector (4)	Fifth side sector pointer
14-15	Track and sector (5)	Six side sector pointer
16-255	Track and sector pointers	Pointers to record blocks

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:
[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:
[SS],[C*]
In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10   :LN=70   :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE":LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,169,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

Mnemonic	Symbol	Keypress
[RIGHT]	]	CRSR left/right
[LEFT]	|	SHIFT & CRSR left/right
[DOWN]	Q	CRSR up/down
[UP]	●	SHIFT & CRSR up/down
[F1]	▔	f1 key
[F2]	◣	SHIFT & f1 key
[F3]	▁	f3 key
[F4]	▝	SHIFT & f3 key
[F5]	|	f5 key
[F6]	▘	SHIFT & f5 key
[F7]	|	f7 key
[F8]	L	SHIFT & f7 key
[HOME]	S	CLR/HOME
[CLR]	♥	SHIFT & CLR/HOME
[RVSON]	R	CTRL & 9
[RVSOFF]	▁	CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]	▜	CTRL & 1
[WHITE]	E	CTRL & 2
[RED]	£	CTRL & 3
[CYAN]	◥	CTRL & 4
[PURPLE]	▚	CTRL & 5
[GREEN]	↑	CTRL & 6
[BLUE]	←	CTRL & 7
[YELLOW]	π	CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

YOUR COMMODORE

Listings

SECRET WRITING

PROGRAM: CAESAR CIPHER

```
3B   10 REM *********************
     **********
41   20 REM *          CAESAR CIPHE
     R         *
6E   30 REM *--------------------
     ---------*
4B   40 REM *  BY N.HIGGINS APRIL
      1988     *
73   50 REM *********************
     **********
B3   60 REM
33   70 POKE53280,6:POKE53281,6
D5   80 PRINT"[CLR,C7,RIGHT5,C029
     ]"
9A   90 PRINT"[RVSON,RIGHT5] ** C
     AESAR CIPHER PROGRAM ** "
8C   100 PRINT "[WHITE,DOWN3,RIGH
     T5]WHICH OPTION DO YOU REQUI
     RE?"
6D   110 PRINT"[WHITE,DOWN3,RIGHT
     10,RVSON]E[RVSOFF,C7]NCIPHER
      OR [RVSON,WHITE]D[RVSOFF,C7
     ]ECIPHER."
FA   120 GETMD$:IFMD$=""THEN120
03   130 IFMD$<>"D"ANDMD$<>"E"THE
     N120
66   140 INPUT"[CLR,WHITE,DOWN2,R
     IGHT2]ENTER KEYNUMBER (1-25)
     :";N
64   150 IFN>0ANDN<26ANDN=INT(N)T
     HEN170
3D   160 PRINT"[UP,RIGHT2]ONLY NU
     MBERS BETWEEN 1-25 !!":FORI=
     1TO1200:NEXT:GOTO140
94   170 PRINT"[CLR,DOWN2,RIGHT2]
     ENTER TEXT (LETTERS A-Z):":I
     NPUT"[DOWN,RIGHT2]";T$
1A   180 LK=LEN(T$):IFLK<1THEN170

50   190 FORI=1TOLK
F2   200 IFMID$(T$,I,1)=" "THEN23
     0
8F   210 IFMID$(T$,I,1)>="A"ANDMI
     D$(T$,I,1)<="Z"THEN230
7B   220 PRINT"[CLR,DOWN2,RIGHT2]
     LETTERS A-Z ONLY !!":FORJ=1T
     O800:NEXTJ:RUN
AD   230 NEXTI
A7   240 J=N:PRINT"[CLR,DOWN]"
CA   250 GOSUB740
54   260 IFMD$="E"THENPRINT"[DOWN
     2,RVSON,C7] DECIPHERED TEXT
     [RVSOFF]:[WHITE]";T$:GOTO300

66   270 N=-N:J=J-1
85   280 J=J+1:IFJ>25THENJ=1
2C   290 PRINT"[DOWN2,RVSON,C7] E
     NCIPHERED TEXT [RVSOFF]:[WHI
     TE]";T$
9C   300 PRINT"[RVSON,C7] KEYNUMB
     ER[SPC7,RVSOFF]:[WHITE]";J
57   310 IFMD$="E"THENPRINT"[RVSO
     N,C7] ENCIPHERED TEXT [RVSOF
     F]:[WHITE]";:GOTO330
8E   320 PRINT"[RVSON,C7] DECIPHE
     RED TEXT [RVSOFF]:[WHITE]";
89   330 FORI=1TOLK
E2   340 D$=MID$(T$,I,1)
34   350 IFD$>="A"ANDD$<="Z"THENG
     OTO390
6F   360 PRINT" ";
4C   370 GOTO420
F2   380 REM
CB   390 C=ASC(D$)-65+N
96   400 GOSUB570
21   410 PRINTCHR$(C+65);
70   420 NEXTI
68   430 IFMD$="E"THEN490
B4   440 PRINT:PRINT"[DOWN2,RIGHT
     5,YELLOW] CONTINUE DECIPHERI
     NG? Y/N."
10   450 GETA$:IFA$<>"Y"ANDA$<>"N
     "THEN450
C3   460 IFA$="N"THEN490
16   470 GOSUB720:IFD=1THENC=1:GO
     TO540
DE   480 GOTO530
FE   490 PRINT:PRINT"[DOWN2,RIGHT
     7,YELLOW] CONTINUE PROGRAM?
     Y/N"
28   500 GETA$:IFA$<>"Y"ANDA$<>"N
     "THEN500
B5   510 IFA$="Y"THENRUN
```

```
F2  520 PRINT"[CLR]":END
AD  530 C=1-N
2F  540 GOSUB570
F6  550 N=-C
05  560 GOTO280
34  570 IFC<=25THENGOTO600
E3  580 C=C-26
6D  590 GOTO620
BF  600 IFC>=0THENGOTO620
AC  610 C=C+26
E0  620 RETURN
9C  630 PRINT"[DOWN2,RVSON,C7] A
    LPHABET [RVSOFF]:[WHITE] ABC
    DEFGHIJKLMNOPQRSTUVWXYZ"
D6  640 PRINT"[RVSON,C7,SPC3]CIP
    HER [RVSOFF]:[WHITE] ";
D7  650 FORI=0TO25
74  660 IFB=26THENB=0
D7  670 PRINTCHR$(B+65);
B3  680 B=B+1
7F  690 NEXTI
27  700 PRINT
46  710 RETURN
5C  720 D=D+1:IFD=26THEND=1
FE  730 B=D:GOTO630
7C  740 B=N:D=N:GOTO630
```

PROGRAM: COLUMNAR CIPHER

```
3B  10 REM *********************
    **********
D9  20 REM *        COLUMNAR CIPHE
    R         *
6E  30 REM *---------------------
    ----------*
4B  40 REM *  BY N.HIGGINS APRIL
     1988     *
73  50 REM *********************
    **********
B3  60 REM
33  70 POKE53280,6:POKE53281,6
CC  80 PRINT"[CLR,C7,RIGHT4,C@31
    ]"
39  90 PRINT"[RVSON,RIGHT4] ** C
    OLUMNAR CIPHER PROGRAM ** "
8C  100 PRINT "[WHITE,DOWN3,RIGH
    T5]WHICH OPTION DO YOU REQUI
    RE?"
6D  110 PRINT"[WHITE,DOWN3,RIGHT
    10,RVSON]E[RVSOFF,C7]NCIPHER
     OR [RVSON,WHITE]D[RVSOFF,C7
    ]ECIPHER."
FA  120 GETMD$:IFMD$=""THEN120
03  130 IFMD$<>"D"ANDMD$<>"E"THE
    N120
1E  140 INPUT"[CLR,WHITE,DOWN2,R
    IGHT2]ENTER KEYWORD:";M$
C0  150 LK=LEN(M$):IFLK<1THEN140

70  160 B=0:FORI=1TOLK
92  170 IFMID$(M$,I,1)=" "THENB=
    B+1:GOTO200
4A  180 D$=MID$(M$,I,1)
98  190 IFD$<"A"ORD$>"Z"THENPRIN
    T"[CLR,DOWN2,RIGHT]LETTERS A
    -Z ONLY!":FORI=1TO1200:NEXT:
    RUN
93  200 NEXTI
6F  210 IFB=LKTHENRUN
AC  220 IFLK-B>1THEN240
0D  230 PRINT"[CLR,DOWN2]KEYWORD
     MUST BE AT LEAST 2 LETTERS
    LONG!":FORI=1TO1200:NEXT:RUN

14  240 DIMKW(LK)
7C  250 A=64:D=1
70  260 FORI=1TO26
DA  270 A=A+1
50  280 FORC=1TOLK :REM ** SORT
    KEYWORD INTO ORDER IN KW **
A1  290 IFMID$(M$,C,1)=CHR$(A)TH
    ENKW(D)=C:D=D+1
F2  300 NEXTC
FE  310 NEXTI
C3  320 IFMD$="D"THENPRINT"[CLR,
    DOWN2,RIGHT]ENTER TEXT TO BE
     DECIPHERED:":GOTO340
72  330 PRINT"[CLR,DOWN2,RIGHT]E
    NTER TEXT TO BE ENCIPHERED:"

A7  340 INPUT "[RIGHT2]";T$
49  350 LT=LEN(T$)
08  360 FORI=1TOLT
5B  370 IFI>LTTHEN400
95  380 IFMID$(T$,I,1)>="A"ANDMI
    D$(T$,I,1)<="Z"THEN400
5B  390 PRINT"[CLR,DOWN,RIGHT2]L
    ETTERS A-Z ONLY !":FORI=1TO8
    00:NEXT:RUN
5C  400 NEXTI
7F  410 IFLT>1THEN440
2F  420 RUN
B9  430 LT=LEN(T$)
DD  440 IFLT/LK=INT(LT/LK)THEN46
    0
73  450 T$=T$+"X":GOTO430
75  460 PRINT"[CLR,DOWN4,RVSON,C
    7] KEYWORD[SPC8]:[RVSOFF,WHI
    TE] ";M$
B2  470 IFMD$="D"THENPRINT"[RVSO
    N,C7] ENCIPHERED TEXT:[RVSOF
    F,WHITE] ";T$:GOTO590
4F  480 PRINT"[RVSON,C7] DECIPHE
    RED TEXT:[RVSOFF,WHITE] "T$
7A  490 PRINT"[RVSON,C7] ENCIPHE
    RED TEXT:[RVSOFF,WHITE] ":
7A  500 REM
09  510 REM *** ENCIPHERED HERE
    ***
34  520 FORI=1TOLK
E1  530 FORF=KW(I)TO LTSTEPLK
4C  540 PRINTMID$(T$,F,1);
F0  550 NEXTF
F9  560 NEXTI
B3  570 REM
67  580 GOTO710
A5  590 PRINT"[RVSON,C7] DECIPHE
    RED TEXT:[RVSOFF,WHITE] ";
51  600 REM ** DECIHERING HERE *
    *
C4  610 DIMDT$(LT):CB=0
20  620 FORI=1TOLK
C4  630 FORC=KW(I)TOLTSTEPLK
51  640 CB=CB+1
37  650 DT$(C)=MID$(T$,CB,1)
57  660 NEXTC
6B  670 NEXTI
CB  680 FORI=1TOLT
BE  690 PRINTDT$(I);
85  700 NEXTI
7B  710 PRINT:PRINTTAB(12)"[DOWN
    4]TRY ANOTHER Y/N"
70  720 GETA$:IFA$=""THEN720
A4  730 IFA$="Y"THENRUN
85  740 IFA$="N"THENPRINT"[CLR]"
    :END
B2  750 GOTO720
```

PROGRAM: FRACTION CIPHER

```
3B  10 REM *********************
    **********
F7  11 REM *        FRACTION CIPHE
    R         *
10  12 REM *---------------------
    ----------*
92  13 REM *  BY N.HIGGINS APRIL
     1988     *
37  14 REM *********************
    **********
80  15 REM
7B  30 POKE53280,6:POKE53281,6
94  40 PRINT"[CLR,C7,RIGHT4,C@31
    ]"
FA  50 PRINT"[RVSON,RIGHT4] ** F
    RACTION CIPHER PROGRAM ** "
44  60 PRINT "[WHITE,DOWN3,RIGHT
    5]WHICH OPTION DO YOU REQUIR
    E?"
45  70 PRINT"[WHITE,DOWN3,RIGHT1
    0,RVSON]E[RVSOFF,C7]NCIPHER
    OR [RVSON,WHITE]D[RVSOFF,C7]
    ECIPHER."
E7  80 GETMD$:IFMD$=""THEN80
F0  90 IFMD$<>"D"ANDMD$<>"E"THEN
    80
26  100 INPUT"[CLR,WHITE,DOWN2,R
    IGHT2]ENTER KEYWORD:";M$
3B  105 LK=LEN(M$):IFLK<1THEN100

A3  120 DIMK(26),P(26)
53  150 A=0:B=0
AA  160 FORI=1TOLEN(M$)
B9  165 IFMID$(M$,I,1)=" "THENB=
    B+1:GOTO240
24  170 D$=MID$(M$,I,1)
9C  180 IFD$<"A"ORD$>"Y"THENPRIN
    T"[CLR,DOWN2,RIGHT]LETTERS A
    -Y ONLY!":FORI=1TO900:NEXT:R
    UN
81  190 C=ASC(D$)-64
91  200 IFP(C)>0THEN240
9F  210 A=A+1
67  220 K(A)=C:P(C)=A
BB  240 NEXTI
16  245 IFB=LKTHENRUN
00  250 FORI=1TO25
ED  260 IFP(I)>0THEN300
DA  270 A=A+1
1F  280 K(A)=I
8A  290 P(I)=A
F8  300 NEXTI
F1  310 PRINT"[CLR]"TAB(10)"KEYW
    ORD & ALPHABET [DOWN]"
5F  320 PRINTTAB(15)"[RVSON,C7]
     12345  "
88  330 PRINTTAB(15)"[RVSON] "SP
    C(7)" "
3D  340 PRINTTAB(15)"[RVSON]1"SP
    C(7)" "
06  350 PRINTTAB(15)"[RVSON]2"SP
    C(7)" "
63  360 PRINTTAB(15)"[RVSON]3"SP
    C(7)" "
DC  370 PRINTTAB(15)"[RVSON]4"SP
    C(7)" "
21  380 PRINTTAB(15)"[RVSON]5"SP
    C(7)" "
1C  390 PRINTTAB(15)"[RVSON] "SP
    C(7)" "
18  400 PRINTTAB(15)"[RVSON,SPC9
    ]"
43  410 PRINT"[WHITE]"
DF  420 FORI=0TO4
88  430 FORF=1TO5
81  440 POKE782,16+F:POKE781,4+I
    :SYS65520:PRINTCHR$(K(I*5+F)
    +64)
87  450 NEXTF
98  460 NEXTI
50  470 PRINT"[DOWN2]"
FD  480 IFMD$="D"THENPRINT"[DOWN
    ,RIGHT]ENTER TEXT TO BE DECI
    PHERED:":GOTO500
9E  490 PRINT"[DOWN,RIGHT]ENTER
    TEXT TO BE ENCIPHERED:"
07  500 INPUT "[RIGHT2]";T$
BE  510 LT=LEN(T$):G=LT*2
6B  520 DIMG(G)
D1  530 FORI=1TOLT
EA  540 IFI>LTTHEN570
9F  550 IFMID$(T$,I,1)>="A"ANDMI
    D$(T$,I,1)<="Y"THEN570
51  560 PRINT"[CLR,DOWN,RIGHT2]L
    ETTERS A-Y ONLY !":FORI=1TO8
    00:NEXT:RUN
07  570 NEXTI
```

```
40  580 IFLT>1THEN600
DA  590 RUN
77  600 FORY=11TO24:POKE781,Y:SY
    S59903:NEXTY
2C  610 POKE782,0:POKE781,12:SYS
    65520
05  620 PRINT"[RVSON,C7] KEYWORD
    [SPC8]:[RVSOFF,WHITE] ";M$
6C  630 IFMD$="D"THENPRINT"[RVSO
    N,C7] ENCIPHERED TEXT:[RVSOF
    F,WHITE] ";T$:GOTO810
54  640 PRINT"[RVSON,C7] DECIPHE
    RED TEXT:[RVSOFF,WHITE] "T$
FD  650 PRINT"[RVSON,C7] ENCIPHE
    RED TEXT:[RVSOFF,WHITE] ";
17  660 FORI=1TOLTSTEPG
BD  670 T=G-1
BA  680 IFI+T>LTTHENT=LT-I
B1  690 FORF=0TOT
AB  700 D$=MID$(T$,I+F,1):L=ASC(
    D$)-64
08  710 A=P(L)
9E  720 G(F+1)=INT((A-1)/5)+1
59  730 G(F+T+2)=A-5*(G(F+1)-1)
AA  740 NEXTF
9C  750 FORF=0TO2*TSTEP2
34  760 C=(G(F+1)-1)*5+G(F+2)
32  770 PRINTCHR$ (K(C)+64);
D3  780 NEXTF
E4  790 NEXTI
05  800 GOTO960
DE  810 PRINT"[RVSON,C7] DECIPHE
    RED TEXT:[RVSOFF,WHITE] ";
5C  820 FORI=1TOLTSTEPG
1A  830 T=G-1
FF  840 IFI+T>LTTHEN T=LT-I
D0  850 FORF=0TOT
37  860 D$=MID$(T$,I+F,1):C=ASC(
    D$)-64
1A  870 A=P(C)
A3  880 G(F*2+1)=INT((A-1)/5)+1
B8  890 G(F*2+2)=A-5*(G(F*2+1)-1
    )
4B  900 NEXTF
04  910 FORF=0TOT
2C  920 L=(G(F+1)-1)*5+G(F+T+2)
A9  930 PRINTCHR$ (K(L)+64);
73  940 NEXTF
84  950 NEXTI
32  960 PRINT:PRINTTAB(12)"[DOWN
    4]TRY ANOTHER Y/N"
76  970 GETA$:IFA$=""THEN970
AD  980 IFA$="Y"THENRUN
C2  990 IFA$="N"THENPRINT"[CLR]"
    :END
DC  1000 GOTO970
```

PROGRAM: P.PROTECTOR-DATA

```
E1  100 REM *********************
    ***********
B8  110 REM *     PASSWORD PROTE
    CTOR     *
84  120 REM *--------------------
    ----------*
91  130 REM *  BY N.HIGGINS APRI
    L 1988    *
90  140 REM *--------------------
    ----------*
F6  150 REM *--------------------
    ----------*
43  160 REM *  M/C PROGRAM TO PR
    OTECT A   *
4E  170 REM *  BASIC PROGRAM IN
    MEMORY;   *
BC  180 REM *  WITH A SECRET PAS
    SWORD !   *
E7  190 REM *********************
    ***********
47  200 REM
2B  210 PRINTCHR$(147):POKE53281
    ,0:POKE646,7
68  220 PRINT"[DOWN2,RIGHT]PLEAS
    E WAIT - POKEING IN MACHINE
    CODE"
D1  230 GOSUB470:POKE53280,0
BD  240 PRINT"[CLR,DOWN2,RIGHT]P
    ASSWORD PROTECTOR M/C NOW IN
     MEMORY"
30  250 PRINT"[DOWN2,RIGHT2]SELE
    CT OPTION (1-3)"
72  260 PRINT"[DOWN2,RIGHT2](1)
    SAVE CODE TO DISK"
63  270 PRINT"[DOWN,RIGHT2](2) S
    AVE CODE TO TAPE"
E3  280 PRINT"[DOWN,RIGHT2](3) E
    XIT"
DD  290 GETA$:IFA$=""THEN290
8A  300 A=VAL(A$):IFA<1ORA>3THEN
    290
9A  310 IFA=3THEN430
E3  320 A$="PREPARE CASSETTE FOR
     SAVING":D=1
F2  330 IFA=1THENA$="PLACE REQUI
    RED DISK IN DRIVE":D=8
CC  340 PRINT"[CLR,RIGHT]";A$:PR
    INT"[DOWN3,RIGHT3]PRESS ANY
    KEY WHEN READY"
E2  350 POKE198,0:WAIT198,1:POKE
    198,0
C6  360 REM ------ SAVE MACHINE
    CODE -------
36  370 SYS57812"P.PROTECTOR M/C
    ",D,1:REM * FILENAME *
F3  380 POKE193,0:POKE194,192:RE
    M * START ADDRESS TO SAVE ($
    C000) *
79  390 POKE174,159:POKE175,199:
    REM * END ADDRESS TO SAVE-1
    ($C79E) *
1E  400 REM
B1  410 SYS62957:REM * PERFORM S
    AVE *
2A  420 REM
F3  430 PRINT"[CLR,DOWN,RIGHT]OK
    AY - SYS49152 TO PROTECT A P
    ROGRAM"
39  440 END
0E  470 FORL=0TO122:CX=0:FORD=0T
    O15:READA:CX=CX+A:POKE49152+
    L*16+D,A:NEXTD
68  480 POKE53280,(PEEK(53280)AN
    D15)+1
7C  490 READA:IFA<>CXTHENPRINT"E
    RROR IN LINE";510+(L*10):STO
    P
87  500 NEXTL:RETURN
F4  510 DATA165,157,48,1,96,173,
    32,208,174,33,208,172,134,2,
    141,92,1836
60  520 DATA192,142,91,192,140,9
    3,192,169,0,141,32,208,141,3
    3,208,169,2143
B9  530 DATA54,160,196,32,30,171
    ,32,228,255,201,133,208,3,76
    ,36,193,2008
5C  540 DATA201,134,208,3,76,94,
    192,201,136,208,235,32,68,22
    9,173,91,2281
9D  550 DATA192,141,33,208,173,9
    2,192,141,32,208,173,93,192,
    141,134,2,2147
9F  560 DATA24,162,20,160,0,32,2
    40,255,76,116,164,246,254,14
    ,32,68,1863
88  570 DATA229,32,250,192,169,4
    8,133,252,169,2,133,253,169,
    0,133,144,2308
8A  580 DATA169,36,133,251,169,2
    51,133,187,169,0,133,188,165
    ,253,133,183,2553
58  590 DATA169,8,133,186,169,96
    ,133,185,32,213,243,165,186,
    32,180,255,2385
4B  600 DATA165,185,32,150,255,1
    64,144,208,74,160,6,132,251,
    32,165,255,2378
51  610 DATA166,252,133,252,164,
    144,208,59,164,251,136,208,2
    38,164,252,32,2823
91  620 DATA205,189,32,59,171,32
    ,165,255,166,144,208,39,170,
    240,6,32,2113
B4  630 DATA210,255,76,181,192,3
    2,215,170,32,250,192,32,228,
    255,201,3,2524
E5  640 DATA240,34,201,32,208,9,
    32,228,255,240,251,201,3,240
    ,21,160,2355
E3  650 DATA4,208,184,32,70,246,
    169,3,160,193,32,30,171,32,2
    28,255,2017
4D  660 DATA240,251,208,3,32,70,
    246,76,31,192,162,6,32,59,17
    1,202,1981
D0  670 DATA208,250,96,5,13,32,3
    2,32,32,32,32,32,32,32,32,65
    ,957
0E  680 DATA78,89,32,75,69,89,32
    ,84,79,32,67,79,78,84,73,78,
    1118
E7  690 DATA85,69,13,0,160,1,177
    ,43,208,49,169,52,160,193,32
    ,30,1441
02  700 DATA171,76,230,192,147,5
    ,17,32,32,32,32,32,32,32,69,
    82,1213
58  710 DATA82,79,82,32,45,32,78
    ,79,32,66,65,83,73,67,32,80,
    1007
D4  720 DATA82,79,71,82,65,77,13
    ,13,13,13,0,169,21,160,197,3
    2,1087
75  730 DATA30,171,32,228,255,20
    1,68,240,6,201,84,240,7,208,
    243,162,2376
E4  740 DATA8,76,118,193,162,1,3
    2,186,255,169,15,160,196,32,
    30,171,1804
7B  750 DATA169,0,133,2,32,8,196
    ,32,228,255,240,251,201,13,2
    40,44,2044
FE  760 DATA201,32,240,12,201,20
    ,240,24,201,48,144,235,201,9
    1,176,231,2297
D3  770 DATA166,2,224,14,176,225
    ,157,37,196,32,210,255,230,2
    ,208,215,2349
38  780 DATA166,2,240,211,32,210
    ,255,198,2,76,135,193,166,2,
    240,199,2327
C3  790 DATA169,40,157,37,196,23
    2,169,88,157,37,196,232,138,
    162,37,160,2207
6C  800 DATA196,32,189,255,169,1
    ,133,204,32,63,171,32,215,17
    0,32,68,1962
33  810 DATA229,169,199,160,198,
    32,30,171,169,0,133,2,32,8,1
    96,32,1760
7D  820 DATA228,255,240,251,201,
    13,240,43,201,20,240,27,201,
    65,144,239,2608
DA  830 DATA201,90,176,235,166,2
    ,224,15,176,229,32,210,255,5
    6,233,64,2364
B9  840 DATA157,7,199,230,2,208,
    216,166,2,240,212,32,210,255
    ,198,2,2336
3C  850 DATA76,236,193,166,2,240
    ,200,169,0,157,7,199,32,63,1
    71,169,2080
CC  860 DATA1,133,204,32,215,170
    ,32,59,195,160,0,152,153,7,1
    99,200,1912
7E  870 DATA192,80,208,248,169,9
    0,133,251,169,10,133,252,24,
    165,45,133,2302
88  880 DATA98,133,105,105,89,13
```

```
    3,253,133,100,165,46,133,99,
    133,106,105,1936
68  890 DATA0,133,254,133,101,23
    0,254,230,254,230,101,230,10
    1,56,165,253,2725
9B  900 DATA229,251,133,107,133,
    109,165,254,229,252,133,108,
    133,110,230,108,2684
5D  910 DATA230,110,160,0,177,98
    ,145,253,165,107,208,6,198,1
    08,165,108,2238
D1  920 DATA240,21,198,107,165,9
    8,208,2,198,99,198,98,165,25
    3,208,2,2260
54  930 DATA198,254,198,253,76,1
    32,194,169,90,133,43,169,10,
    133,44,165,2261
C5  940 DATA100,133,45,165,101,1
    33,46,32,51,165,32,89,166,17
    3,90,10,1531
21  950 DATA73,255,141,103,199,1
    69,0,141,90,10,162,0,189,64,
    197,157,1950
BC  960 DATA1,8,189,64,198,157,1
    ,9,232,208,241,189,64,199,15
    7,1,1918
40  970 DATA10,232,224,89,208,24
    5,169,1,133,43,169,8,133,44,
    32,89,1829
FA  980 DATA225,169,1,133,251,16
    9,8,133,252,169,90,133,253,1
    69,10,133,2298
58  990 DATA254,160,0,177,253,14
    5,251,165,109,208,6,198,110,
    165,110,240,2551
81  1000 DATA17,198,109,230,253,
    208,2,230,254,230,251,208,2,
    230,252,76,2750
F0  1010 DATA3,195,169,1,133,43,
    169,8,133,44,165,105,133,45,
    165,106,1617
A8  1020 DATA133,46,32,51,165,32
    ,89,166,76,31,192,169,7,133,
    253,169,1744
92  1030 DATA199,133,254,169,0,1
    33,2,169,221,133,251,169,198
    ,133,252,162,2578
01  1040 DATA1,160,0,177,253,240
    ,44,209,251,240,16,200,192,5
    ,208,247,2443
CD  1050 DATA72,32,250,195,232,1
    60,0,104,76,87,195,200,152,7
    2,164,2,1993
E1  1060 DATA138,153,23,199,104,
    153,39,199,230,2,230,253,208
    ,2,230,254,2417
43  1070 DATA76,71,195,169,23,13
    3,251,169,199,133,252,162,0,
    134,2,169,2138
62  1080 DATA150,141,194,195,160
    ,0,177,251,240,23,166,2,157,
    55,199,200,2310
BE  1090 DATA177,251,240,8,157,7
    1,199,230,2,200,208,234,169,
    160,141,194,2641
25  1100 DATA195,165,251,201,39,
    240,13,169,39,133,251,169,19
    9,133,252,160,2609
59  1110 DATA0,76,150,195,160,0,
    132,2,169,221,133,251,169,19
    8,133,252,2241
7B  1120 DATA164,2,185,55,199,24
    0,20,32,236,195,185,71,199,1
    68,136,177,2264
7A  1130 DATA251,164,2,153,247,1
    98,230,2,76,200,195,96,201,1
    ,240,9,2265
A8  1140 DATA170,32,250,195,202,
    224,1,208,248,96,24,165,251,
    105,5,133,2309
7D  1150 DATA251,165,252,105,0,1
    33,252,96,169,0,133,204,133,
    207,96,147,2343
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69  1160 DATA17,17,17,32,32,69,7
    8,84,69,82,32,70,73,76,69,78
    ,895
FB  1170 DATA65,77,69,58,0,0,0,0
    ,0,0,0,0,0,0,0,0,269
6D  1180 DATA0,0,0,0,0,0,147,17,
    158,32,32,32,32,32,32,32,546
A6  1190 DATA228,228,228,228,228
    ,228,228,228,228,228,228,228
    ,228,228,228,228,3648
8E  1200 DATA228,228,228,228,228
    ,228,228,228,228,228,13,32,3
    2,32,32,32,2453
AE  1210 DATA32,32,18,32,42,42,3
    2,80,65,83,83,87,79,82,68,32
    ,889
52  1220 DATA80,82,79,84,69,67,8
    4,79,82,32,42,42,32,13,13,32
    ,912
65  1230 DATA32,32,32,32,32,32,3
    2,32,32,32,40,67,41,32,78,46
    ,624
B9  1240 DATA72,73,71,71,73,78,8
    3,32,49,57,56,56,13,13,13,13
    ,823
4D  1250 DATA32,32,32,32,32,32,3
    2,32,32,32,32,32,32,32,32,32
    ,512
DD  1260 DATA83,69,76,69,67,84,1
    3,13,13,32,32,32,32,32,40,70
    ,757
D2  1270 DATA49,41,32,32,80,82,7
    9,84,69,67,84,32,66,65,83,73
    ,1018
E5  1280 DATA67,32,80,82,79,71,8
    2,65,77,13,13,32,32,32,32,32
    ,821
12  1290 DATA40,70,51,41,32,32,8
    2,69,65,68,32,68,73,83,75,32
    ,913
D4  1300 DATA68,73,82,69,67,84,7
    9,82,89,13,13,32,32,32,32,32
    ,879
D9  1310 DATA40,70,55,41,32,32,6
    9,88,73,84,32,84,79,32,66,65
    ,942
E7  1320 DATA83,73,67,13,0,147,1
    7,17,17,17,17,32,32,32,32,32
    ,628
AC  1330 DATA83,65,86,69,32,84,7
    9,32,68,73,83,75,32,79,82,32
    ,1054
95  1340 DATA84,65,80,69,46,46,4
    6,46,40,84,47,68,41,13,0,0,7
    75
59  1350 DATA71,8,0,0,158,50,49,
    50,49,58,20,20,20,20,20,20,6
    13
E8  1360 DATA20,20,20,20,5,42,42
    ,32,80,65,83,83,87,79,82,68,
    828
0B  1370 DATA32,80,82,79,84,69,6
    7,84,79,82,32,42,42,13,13,29
    ,909
B3  1380 DATA29,29,40,67,41,32,7
    8,46,72,73,71,71,73,78,83,32
    ,915
DF  1390 DATA49,57,56,56,13,0,0,
    0,32,68,229,169,0,141,32,208
    ,1110
63  1400 DATA141,33,208,169,234,
    141,40,3,169,136,160,9,32,30
    ,171,169,1845
E0  1410 DATA226,133,106,169,252
    ,133,107,169,0,133,2,133,204
    ,133,207,32,2139
97  1420 DATA228,255,240,251,201
    ,13,240,43,201,20,240,27,201
    ,65,144,239,2608
24  1430 DATA201,90,176,235,166,
    2,224,15,176,229,32,210,255,
    56,233,64,2364
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69  1440 DATA157,200,9,230,2,208
    ,216,166,2,240,212,32,210,25
    5,198,2,2339
7B  1450 DATA76,112,8,166,2,240,
    200,169,0,157,200,9,169,1,13
    3,204,1846
FC  1460 DATA32,68,229,169,200,1
    33,253,169,9,133,254,169,0,1
    33,2,169,2122
9E  1470 DATA158,133,251,169,9,1
    33,252,162,1,160,0,177,253,2
    40,44,209,2351
A9  1480 DATA251,240,16,200,192,
    5,208,247,72,32,122,9,232,16
    0,0,104,2090
44  1490 DATA76,208,8,200,152,72
    ,164,2,138,153,216,9,104,153
    ,232,9,1896
F4  1500 DATA230,2,230,253,208,2
    ,230,254,76,192,8,169,216,13
    3,251,169,2623
E6  1510 DATA9,133,252,162,0,134
    ,2,160,0,177,251,240,23,166,
    2,157,1868
C7  1520 DATA248,9,200,177,251,2
    40,8,157,8,10,230,2,200,208,
    234,169,2351
2A  1530 DATA20,141,54,9,165,251
    ,201,232,240,13,169,232,133,
    251,169,9,2289
8B  1540 DATA133,252,160,0,76,10
    ,9,160,0,132,2,169,158,133,2
    51,169,1814
1E  1550 DATA9,133,252,164,2,185
    ,248,9,240,22,32,108,9,185,8
    ,10,1616
03  1560 DATA168,136,177,251,164
    ,2,217,184,9,208,13,230,2,76
    ,60,9,1906
EF  1570 DATA185,184,9,208,3,76,
    24,10,76,56,10,201,1,240,9,1
    70,1462
0F  1580 DATA32,122,9,202,224,1,
    208,248,96,24,165,251,105,5,
    133,251,2076
78  1590 DATA165,252,105,0,133,2
    52,96,158,17,17,17,29,29,69,
    78,84,1501
F8  1600 DATA69,82,32,80,65,83,8
    3,87,79,82,68,58,0,14,5,9,89
    6
2A  1610 DATA12,8,7,19,15,11,1,2
    5,2,3,4,6,10,13,16,17,169
C3  1620 DATA18,20,21,22,23,24,0
    ,0,0,0,0,0,0,0,0,0,128
17  1630 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
1D  1640 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
2B  1650 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
31  1660 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
3F  1670 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
4D  1680 DATA0,0,0,0,0,0,0,169,2
    37,141,40,3,169,90,133,43,10
    25
82  1690 DATA169,10,133,44,160,0
    ,169,0,73,255,145,43,169,174
    ,133,106,1783
90  1700 DATA169,167,133,107,32,
    89,166,169,1,133,251,169,8,1
    33,252,162,2141
AC  1710 DATA2,160,0,152,145,251
    ,200,208,251,230,252,202,208
    ,246,145,251,2903
45  1720 DATA200,192,76,208,249,
    108,106,0,0,0,0,0,0,0,99,1
    238
F2  1730 DATA99,51,106,107,170,4
    1,126,119,106,247,46,63,40,1
    04,106,54,1585
```

HIDDEN POWERS

PROGRAM: PROG1/EL

```
16   10 GOTO 50000
78   15993 DATA 10,8,10,0,158,50,
     48,54
62   16001 DATA 49,0,0,0,32,68,22
     9,162
03   16009 DATA 0,142,133,9,32,17
     3,8,174
B9   16017 DATA 133,9,189,195,8,2
     40,6,32
C1   16025 DATA 210,255,232,208,2
     45,232,189,195
1A   16033 DATA 8,208,230,32,207,
     255,201,13
8A   16041 DATA 208,249,160,0,185
     ,2,5,201
99   16049 DATA 48,175,8,201,7,17
     6,39,105
93   16057 DATA 9,208,7,56,233,48
     ,201,10
E8   16065 DATA 176,28,192,1,240,
     10,10,10
EC   16073 DATA 10,10,141,133,9,2
     00,208,220
A1   16081 DATA 13,133,9,141,129,
     9,169,0
F1   16089 DATA 141,128,9,76,109,
     8,239,32
F7   16097 DATA 208,76,13,8,234,1
     69,136,133
99   16105 DATA 73,169,9,133,74,1
     73,130,9
61   16113 DATA 133,75,173,131,9,
     133,76,160
D8   16121 DATA 0,162,0,177,73,20
     5,132,9
7F   16129 DATA 208,14,161,75,24,
     109,129,9
30   16137 DATA 145,73,230,75,208
     ,2,230,76
6C   16145 DATA 200,208,2,230,74,
     204,130,9
62   16153 DATA 208,225,165,74,20
     5,131,9,208
3C   16161 DATA 218,76,248,8,162,
     0,189,187
BA   16169 DATA 8,240,6,32,210,25
     5,232,208
69   16177 DATA 245,96,13,13,29,2
     9,29,29
96   16185 DATA 29,0,42,80,82,79,
     71,82
4A   16193 DATA 65,77,32,82,69,76
     ,79,67
1A   16201 DATA 65,84,79,82,42,0,
     76,69
4A   16209 DATA 78,71,84,72,61,32
     ,36,48
40   16217 DATA 49,55,70,0,82,69,
     76,79
30   16225 DATA 67,65,84,69,32,84
     ,79,58
68   16233 DATA 36,67,48,48,48,0,
     0,169
16   16241 DATA 0,133,73,173,129,
     9,133,74
49   16249 DATA 169,136,133,75,16
     9,9,133,76
74   16257 DATA 160,0,177,75,145,
     73,230,73
60   16265 DATA 208,2,230,74,230,
     75,208,2
F8   16273 DATA 230,76,165,75,205
     ,130,9,208
59   16281 DATA 233,165,76,205,13
     1,9,208,226
8B   16289 DATA 32,173,8,162,0,18
     9,95,9
DD   16297 DATA 240,6,32,210,255,
     232,208,245
C0   16305 DATA 32,228,255,240,25
     1,201,89,240
A9   16313 DATA 26,32,173,8,162,0
     ,189,111
71   16321 DATA 9,240,6,32,210,25
     5,232,208
AB   16329 DATA 245,174,129,9,173
     ,129,9,32
9B   16337 DATA 205,189,96,108,12
     8,9,82,85
BF   16345 DATA 78,32,78,79,87,63
     ,32,40
A0   16353 DATA 89,47,78,41,32,0,
     83,89
24   16361 DATA 83,32,65,68,68,82
     ,69,83
6A   16369 DATA 83,32,73,83,58,32
     ,0,0
74   16377 DATA 0,7,10,4,0,0,0,12
     0
56   16385 DATA 173,0,3,141,37,4,
     173,1
A2   16393 DATA 3,141,38,4,173,20
     ,3,141
F7   16401 DATA 39,4,173,21,3,141
     ,40,4
70   16409 DATA 169,41,141,0,3,16
     9,4,141
D1   16417 DATA 1,3,99,95,139,227
     ,48,234
EC   16425 DATA 169,54,141,20,3,1
     69,4,141
F7   16433 DATA 21,3,108,37,4,169
     ,248,141
80   16441 DATA 47,208,160,0,169,
     255,141,0
C5   16449 DATA 220,141,167,2,173
     ,1,220,201
38   16457 DATA 255,240,37,169,25
     4,141,47,208
A0   16465 DATA 162,8,72,173,1,22
     0,205,1
8F   16473 DATA 220,208,248,74,14
     4,14,200,192
04   16481 DATA 24,240,9,202,208,
     245,104,56
AC   16489 DATA 42,76,78,4,104,14
     0,167,2
7F   16497 DATA 169,255,141,47,20
     8,169,127,141
99   16505 DATA 0,220,108,39,4,0,
     0,0
B9   16513 DATA 0,0,0,0,0,0,0,255
     ,256
99   50000 M=2049:PRINT"[CLR,DOWN
     2,RIGHT3,RVSON]LOCATION:[RVS
     OFF]"
33   50010 FORL=0TO1:L=0
A1   50020 READV:IFV=256THENL=1:G
     OTO50050
B7   50030 POKEM,V:PRINT"[HOME,DO
     WN2,RIGHT12]";M
3E   50040 M=M+1
C7   50050 NEXT
86   50060 INPUT"[CLR,DOWN3,RIGHT
     2]FILENAME";F$
D0   50070 INPUT"[DOWN2,RIGHT2]TA
     PE(T)/DISC(D)";D$
FB   50080 IFF$=""ORD$<>"T"ANDD$<
     >"D"THEN50060
06   50085 D=1*ABS(D$="T")+8*ABS(
     D$="D")
29   50090 PRINT"[CLR,DOWN2]SAVE"
     CHR$(34);F$;CHR$(34);",";D
CC   50094 H=INT(M/256):L=M-H*256
     :POKE252,L:POKE253,H
8C   50095 POKE46,PEEK(253):POKE4
     5,PEEK(252)
8D   50100 POKE631,13:POKE198,1:P
     RINT"[HOME]";
```

PROGRAM: PROG2/BL

```
16   10 GOTO 50000
78   15993 DATA 10,8,10,0,158,50,
     48,54
62   16001 DATA 49,0,0,0,32,68,22
     9,162
03   16009 DATA 0,142,133,9,32,17
     3,8,174
B8   16017 DATA 133,9,189,195,8,2
     40,6,32
C1   16025 DATA 210,255,232,208,2
     45,232,189,195
1A   16033 DATA 8,208,230,32,207,
     255,201,13
8A   16041 DATA 208,249,160,0,185
     ,2,5,201
98   16049 DATA 48,175,8,201,7,17
     6,39,105
83   16057 DATA 9,208,7,56,233,48
     ,201,10
E8   16065 DATA 176,28,192,1,240,
     10,10,10
EC   16073 DATA 10,10,141,133,9,2
     00,208,220
A1   16081 DATA 13,133,9,141,129,
     9,169,0
F1   16089 DATA 141,128,9,76,109,
     8,238,32
F7   16097 DATA 208,76,13,8,234,1
     69,136,133
99   16105 DATA 73,169,9,133,74,1
     73,130,9
61   16113 DATA 133,75,173,131,9,
     133,76,160
D8   16121 DATA 0,162,0,177,73,20
     5,132,9
7F   16129 DATA 208,14,161,75,24,
     109,129,9
30   16137 DATA 145,73,230,75,208
     ,2,230,76
6C   16145 DATA 200,208,2,230,74,
     204,130,9
62   16153 DATA 208,225,165,74,20
     5,131,9,208
3C   16161 DATA 218,76,248,8,162,
     0,189,187
BA   16169 DATA 8,240,6,32,210,25
     5,232,208
69   16177 DATA 245,96,13,13,29,2
     9,29,29
96   16185 DATA 29,0,42,80,82,79,
     71,82
4A   16193 DATA 65,77,32,82,69,76
     ,79,67
1A   16201 DATA 65,84,79,82,42,0,
     76,69
4A   16209 DATA 78,71,84,72,61,32
     ,36,48
86   16217 DATA 48,57,55,0,82,69,
     76,79
30   16225 DATA 67,65,84,69,32,84
     ,79,58
6B   16233 DATA 36,67,48,48,48,0,
     0,169
16   16241 DATA 0,133,73,173,129,
     9,133,74
49   16249 DATA 169,136,133,75,16
     9,9,133,76
74   16257 DATA 160,0,177,75,145,
     73,230,73
60   16265 DATA 208,2,230,74,230,
     75,208,2
F9   16273 DATA 230,76,165,75,205
     ,130,9,208
59   16281 DATA 233,165,76,205,13
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     1,9,208,226
BB   16289 DATA 32,173,8,162,0,18
     9,95,9
DD   16297 DATA 240,6,32,210,255,
     232,208,245
C0   16305 DATA 32,228,255,240,25
     1,201,89,240
A9   16313 DATA 26,32,173,8,162,0
     ,189,111
71   16321 DATA 9,240,5,32,210,25
     5,232,208
AB   16329 DATA 245,174,128,9,173
     ,128,9,32
95   16337 DATA 205,189,95,128,12
     8,9,82,85
BF   16345 DATA 78,32,78,79,87,63
     ,32,40
A0   16353 DATA 89,47,78,41,32,0,
     83,89
24   16361 DATA 83,32,65,68,58,82
     ,69,83
6A   16369 DATA 83,32,73,83,58,32
     ,0,0
08   16377 DATA 0,79,10,5,0,0,0,1
     20
55   16385 DATA 173,0,3,141,37,5,
     173,1
A3   16393 DATA 3,141,38,5,173,20
     ,3,141
67   16401 DATA 39,5,173,21,3,141
     ,40,5
69   16409 DATA 169,41,141,0,3,16
     9,5,141
D1   16417 DATA 1,3,88,96,139,227
     ,49,234
ED   16425 DATA 169,54,141,20,3,1
     69,5,141
F6   16433 DATA 21,3,108,37,5,169
     ,248,141
80   16441 DATA 47,208,160,0,169,
     255,141,0
C5   16449 DATA 220,141,167,2,173
     ,1,220,201
38   16457 DATA 255,240,37,169,25
     4,141,47,208
A0   16465 DATA 162,8,72,173,1,22
     0,205,1
8F   16473 DATA 220,208,248,74,14
     4,14,200,192
04   16481 DATA 24,240,9,202,208,
     245,104,56
1D   16489 DATA 42,76,78,5,104,14
     0,167,2
7F   16497 DATA 169,255,141,47,20
     8,169,127,141
5C   16505 DATA 0,220,234,172,167
     ,2,48,38
3D   16513 DATA 204,168,2,208,14,
     192,19,144
75   16521 DATA 29,206,197,5,208,
     24,169,4
13   16529 DATA 141,197,5,166,199
     ,185,173,5
1D   16537 DATA 201,255,240,10,15
     7,119,2,232
6C   16545 DATA 224,11,176,2,134,
     198,140,168
A3   16553 DATA 2,108,39,5,255,56
     ,53,255
79   16561 DATA 50,52,55,49,255,4
     3,45,141
05   16569 DATA 13,54,57,51,255,4
     8,46,145
24   16577 DATA 17,157,29,255,4,0
     ,0,0
1E   16585 DATA 0,0,0,0,0,0,0,0
7F   16593 DATA 0,0,0,256
99   50000 M=2048:PRINT"[CLR,DOWN
     2,RIGHT3,RVSON]LOCATION:[RVS
     OFF]"
33   50010 FORL=0TO1:L=0
A1   50020 READV:IFV=256THENL=1:G
     OTO50050
B7   50030 POKEM,V:PRINT"[HOME,DO
     WN2,RIGHT12]";M
3E   50040 M=M+1
C7   50050 NEXT
86   50060 INPUT"[CLR,DOWN3,RIGHT
     2]FILENAME";F$
D0   50070 INPUT"[DOWN2,RIGHT2]TA
     PE(T)/DISC(D)";D$
FB   50080 IFF$=""ORD$<>"T"ANDD$<
     >"D"THEN50060
06   50085 D=1*ABS(D$="T")+8*ABS(
     D$="D")
29   50090 PRINT"[CLR,DOWN2]SAVE"
     CHR$(34);F$;CHR$(34);",";D
CC   50094 H=INT(M/256):L=M-H*255
     :POKE252,L:POKE253,H
9C   50095 POKE46,PEEK(253):POKE4
     5,PEEK(252)
8D   50100 POKE631,13:POKE198,1:P
     RINT"[HOME]";
```

Listings

TALKING COMPUTERS

```
PROGRAM: HEAD SPRITE LDR
```

```
88   100 REM ********************
95   110 REM *                  *
10   120 REM * HEAD SPRITE DATA *
47   130 REM *   FOR USE WITH   *
D4   140 REM *   LIPSYNC DEMO   *
14   150 REM *        BY        *
C0   160 REM *    MIKE BENN     *
D9   170 REM *                  *
D8   180 REM ********************
1B   190 BL=55    :LN=300   :SA=154
     88
FD   200 FOR L=0 TO BL:CX=0:FOR D
     =0 TO 15
F3   210 READ A:IF A>255THENPRINT
     "NUMBER TO LARGE";LN+(L*10):
     STOP
E4   220 CX=CX+A:POKE SA+L*16+D,A
     :NEXT D
AD   230 READ A:IF A><CX THENPRIN
     T"ERROR IN LINE";LN+(L*10):S
     TOP
D7   240 NEXT L:POKE43,128:POKE44
     ,60:POKE45,0:POKE46,64
1E   250 SAVE"HEAD SPRITE DATA",8
     ,1:END
80   260 REM ********************
     *********
3F   270 REM *  TAPE USERS WILL N
     EED TO  *
1B   280 REM * DEVICE NUMBER FROM
      8 TO 1 *
1E   290 REM ********************
     *********
E5   300 DATA 63,255,251,63,255,2
     51,63,255,255,15,255,255,15,
     255,255,15,2776
D5   310 DATA 255,255,15,255,234,
     3,255,170,3,255,250,0,255,25
     5,0,255,2715
BC   320 DATA 255,0,255,255,0,255
     ,255,0,63,255,0,63,255,0,15,
     255,2181
DA   330 DATA 0,15,255,0,3,255,0,
     3,255,0,0,255,0,0,15,41,1097

16   340 DATA 239,255,252,239,255
     ,252,255,255,252,255,255,240
     ,255,255,240,255,4009
83   350 DATA 255,240,171,255,240
     ,170,255,192,175,255,192,255
     ,255,0,255,255,3420
4C   360 DATA 0,255,255,0,255,255
     ,0,255,252,0,255,252,0,255,2
     40,0,2529
A5   370 DATA 255,240,0,255,192,0
     ,255,192,0,255,0,0,240,0,0,6
     6,1950
75   380 DATA 63,255,251,63,255,2
     51,63,255,255,15,255,255,15,
     255,255,15,2776
50   390 DATA 255,255,15,255,255,
     3,255,250,3,255,224,0,255,25
     0,0,255,2785
EC   400 DATA 255,0,255,255,0,255
     ,255,0,63,255,0,63,255,0,15,
     255,2181
89   410 DATA 0,15,255,0,3,255,0,
     3,255,0,0,255,0,0,15,170,122
     6
66   420 DATA 239,255,252,239,255
     ,252,255,255,252,255,255,240
     ,255,255,240,255,4009
02   430 DATA 255,240,255,255,240
     ,175,255,192,11,255,192,175,
     255,0,255,255,3255
9C   440 DATA 0,255,255,0,255,255
     ,0,255,252,0,255,252,0,255,2
     40,0,2529
2F   450 DATA 255,240,0,255,192,0
     ,255,192,0,255,0,0,240,0,0,2
     55,2139
45   460 DATA 63,255,251,63,255,2
     51,63,255,255,15,255,255,15,
     255,255,15,2776
2D   470 DATA 255,255,15,255,234,
     3,255,128,3,255,228,0,255,24
     0,0,255,2637
5C   480 DATA 255,0,255,255,0,255
     ,255,0,63,255,0,63,255,0,15,
     255,2181
8E   490 DATA 0,15,255,0,3,255,0,
     3,255,0,0,255,0,0,15,119,117
     5
```

```
25   500 DATA 239,255,252,239,255
     ,252,255,255,252,255,255,240
     ,255,255,240,255,4009
B8   510 DATA 255,240,171,255,240
     ,2,255,192,81,255,192,15,255
     ,0,255,255,2928
15   520 DATA 0,255,255,0,255,255
     ,0,255,252,0,255,252,0,255,2
     40,0,2529
5B   530 DATA 255,240,0,255,192,0
     ,255,192,0,255,0,0,240,0,0,1
     39,2023
45   540 DATA 63,255,251,63,255,2
     51,63,255,255,15,255,255,15,
     255,255,15,2776
95   550 DATA 255,250,15,255,240,
     3,255,245,3,255,250,0,255,25
     0,0,255,2786
74   560 DATA 252,0,255,254,0,255
     ,255,0,63,255,0,63,255,0,15,
     255,2177
AF   570 DATA 0,15,255,0,3,255,0,
     3,255,0,0,255,0,0,15,143,119
     9
56   580 DATA 239,255,252,239,255
     ,252,255,255,252,255,255,240
     ,255,255,240,175,3929
D9   590 DATA 255,240,15,255,240,
     95,255,192,175,255,192,175,2
     55,0,63,255,2917
3E   600 DATA 0,191,255,0,255,255
     ,0,255,252,0,255,252,0,255,2
     40,0,2465
06   610 DATA 255,240,0,255,192,0
     ,255,192,0,255,0,0,240,0,0,1
     30,2014
9E   620 DATA 63,255,251,63,255,2
     51,63,255,255,15,255,255,15,
     255,255,15,2776
25   630 DATA 255,250,15,255,240,
     3,255,245,3,255,250,0,255,25
     2,0,255,2788
5E   640 DATA 255,0,255,255,0,255
     ,255,0,63,255,0,63,255,0,15,
     255,2181
B4   650 DATA 0,15,255,0,3,255,0,
     3,255,0,0,255,0,0,15,5,1061
25   650 DATA 239,255,252,239,255
     ,252,255,255,252,255,255,240
     ,255,255,240,175,3929
2A   670 DATA 255,240,15,255,240,
     95,255,192,175,255,192,53,25
     5,0,255,255,2997
35   680 DATA 0,255,255,0,255,255
     ,0,255,252,0,255,252,0,255,2
     40,0,2529
B8   690 DATA 255,240,0,255,192,0
     ,255,192,0,255,0,0,240,0,0,1
     35,2019
15   700 DATA 0,0,5,0,0,85,0,1,85
     ,0,5,85,0,21,85,0,372
B4   710 DATA 85,85,0,95,85,0,95,
     213,1,127,255,1,127,255,5,12
     7,1556
17   720 DATA 255,5,127,255,5,253
     ,127,5,245,95,55,255,255,55,
     241,75,2308
F3   730 DATA 55,253,123,63,255,2
     51,63,255,251,63,255,251,63,
     255,251,182,2889
05   740 DATA 80,0,0,85,0,0,85,64
     ,0,85,80,0,85,84,0,85,733
60   750 DATA 85,0,85,85,0,253,85
     ,0,255,245,64,255,253,64,255
     ,253,2237
72   750 DATA 80,255,253,80,253,1
     27,80,245,95,80,255,255,92,2
     25,79,92,2546
C3   770 DATA 237,127,220,239,255
     ,220,239,255,220,239,255,252
     ,239,255,252,37,3541
42   780 DATA 0,0,5,0,0,85,0,1,85
     ,0,5,85,0,21,85,0,372
63   790 DATA 85,85,0,95,85,0,95,
     213,1,127,255,1,127,255,5,12
     7,1555
FB   800 DATA 255,5,127,255,5,253
     ,127,5,245,95,55,255,255,55,
     255,251,2498
C2   810 DATA 55,255,251,63,255,2
     51,63,255,251,63,255,251,63,
     255,251,140,2977
3C   820 DATA 80,0,0,85,0,0,85,64
     ,0,85,80,0,85,84,0,85,733
AF   830 DATA 85,0,85,85,0,253,85
     ,0,255,245,64,255,253,64,255
     ,253,2237
E3   840 DATA 80,255,253,80,253,1
     27,80,245,95,80,255,255,92,2
     39,255,92,2736
A5   850 DATA 239,255,220,239,255
     ,220,239,255,220,239,255,252
     ,239,255,252,37,3671
```

PROGRAM. LIPSYNC LDR

```
48   100 REM *****************
55   110 REM *               *
F0   120 REM * LIPSYNC LOADER *
3A   130 REM *      BY       *
42   140 REM *   MIKE BENN   *
3D   150 REM *               *
8F   160 REM *****************
25   170 REM
4E   180 BL=18   :LN=300  :SA=493
     33
83   190 FOR L=0 TO BL:CX=0:FOR D
     =0 TO 15
2D   200 READ A:IF A>255THENPRINT
     "NUMBER TO LARGE";LN+(L*10):
     STOP
5E   210 CX=CX+A:POKE SA+L*16+D,A
     :NEXT D
27   220 READ A:IF A><CX THENPRIN
     T"ERROR IN LINE";LN+(L*10):S
     TOP
58   230 NEXT L:POKE43,0:POKE44,1
     92:POKE45,0:POKE46,194
8F   240 SAVE"LIPSYNC MC",8,1:END
D7   250 REM ********************
     *********
C2   260 REM *    TAPE USERS CHAN
     GE      *
71   270 REM * DEVICE NUMBER FROM
      8 TO 1 *
7C   280 REM ********************
     *********
AC   290 REM
89   300 DATA 76,184,192,32,210,1
     93,165,20,141,221,193,32,210
     ,193,165,20,2247
D0   310 DATA 141,222,193,32,253,
     174,32,158,173,32,166,182,14
     1,220,193,165,2477
6F   320 DATA 34,133,100,165,35,1
     33,101,160,0,177,100,153,223
     ,193,200,204,2111
2C   330 DATA 220,193,208,245,169
     ,0,153,223,193,160,0,152,32,
     11,193,168,2320
E4   340 DATA 152,32,11,193,168,1
     85,223,193,240,11,32,23,193,
     152,32,11,1851
C7   350 DATA 193,168,200,208,230
     ,96,152,200,172,222,193,136,
     208,253,202,208,3051
15   360 DATA 247,96,201,45,240,4
     2,201,32,240,30,201,66,240,3
     4,201,77,2202
35   370 DATA 240,30,201,82,240,2
     6,201,70,240,41,201,85,240,3
     7,201,79,2213
99   380 DATA 240,77,201,85,242,1
     10,201,87,240,105,201,90,240
     ,102,208,41,2469
1D   390 DATA 173,221,193,141,248
     ,7,173,221,193,24,105,1,141,
     249,7,32,2129
8F   400 DATA 191,193,96,173,221,
     193,24,105,2,141,248,7,173,2
     21,193,24,2205
F2   410 DATA 105,3,141,249,7,32,
     191,193,96,173,221,193,24,10
     5,4,141,1878
BF   420 DATA 248,7,173,221,193,2
     4,105,5,141,249,7,32,191,193
     ,96,173,2058
69   430 DATA 221,193,24,105,6,14
     1,248,7,173,221,193,24,105,7
     ,141,249,2058
9F   440 DATA 7,173,221,193,24,10
     5,12,141,250,7,173,221,193,2
     4,105,13,1852
85   450 DATA 141,251,7,96,173,22
     1,193,24,105,8,141,248,7,173
     ,221,193,2202
E9   460 DATA 24,105,9,141,249,7,
     32,191,193,96,173,221,193,24
     ,105,10,1773
2C   470 DATA 141,250,7,173,221,1
     93,24,105,11,141,251,7,95,32
     ,253,174,2079
FD   480 DATA 32,138,173,32,247,1
     83,96,0,0,0,0,0,0,0,0,0,901
```

PROGRAM: LIPSYNC DEMO

```
08   100 REM ****************
15   110 REM *              *
90   120 REM * LIPSYNC DEMO *
31   130 REM *              *
BF   140 REM * BY MIKE BENN *
3D   150 REM *              *
4F   160 REM ****************
25   170 REM
5B   180 REM ****************
65   190 REM *              *
17   200 REM * THIS PROGRAM *
27   210 REM * IS BASED ON  *
9B   220 REM *  THE CURRAH  *
05   230 REM *  SPEECH  64  *
10   240 REM *     AND      *
E9   250 REM * MAY  REQUIRE *
99   260 REM * ADDAPTATION  *
C4   270 REM * FOR USE WITH *
18   280 REM * OTHER SPEECH *
7F   290 REM *   SOFTWARE   *
D2   300 REM *              *
7B   310 REM ****************
CE   320 REM
D9   330 POKE55,0:POKE56,60 :REM
     LOWER TOP OF BASIC TO PROTEC
     T SPRITE DATA
26   340 PRINTCHR$(147)
8A   350 X=X+1
4E   360 IFX=1THENLOAD"LIPSYNC MC
     ",8,1
54   370 IFX=2THENLOAD"HEAD SPRIT
     E DATA",8,1
D2   380 REM INIT. SCREEN & SPRIT
     ES
EB   390 V=53248:X=140:Y=100:C=2:
     SA=49333
EF   400 POKEV+32,3:POKEV+33,3:PO
     KEV+28,15
21   410 POKEV+21,15:POKEV+23,15:
     POKEV+29,15
36   420 POKEV+37,0:POKEV+38,10:P
     OKEV+39,C:POKEV+40,C:POKEV+4
     1,C:POKEV+42,C
AD   430 POKEV,X:POKEV+1,Y+42:REM
      LOWER HEAD
6F   440 POKEV+2,X+48:POKEV+3,Y+4
     2
```

```
1C  450 POKEV+4,X:POKEV+5,Y:REM
    UPPER HEAD
6F  460 POKEV+6,X+48:POKEV+7,Y
C0  470 SP$="HELLO THERE ! THOUG
    HT JUST SHOW MY FACE IN THIS
     SHORT DEMO."
7E  480 SP$=SP$+"IF YOU DONT LIK
    E THE LOOK OF ME YOU CAN ALW
    AYS CHANGE ME "
FD  490 SP$=SP$+"AND WHILE IM HE
    RE COULD YOU DESIGN ME A BOD
    Y BYE FOR NOW."
76  500 REM INITALISE YOUR SPEEC
    H SOFTWARE
A1  510 INIT
E6  520 PRINT"[HOM][10CD][17CR][C
    WHT][REV][7SPC][OFF]"
87  530 PRINT"[2CD][18CR][REV][5
    SPC][OFF]"
4C  540 REM COMMAND YOUR SPEECH
    SOFTWARE TO READ SP$
B2  550 SAY SP$
A4  560 SYS SA,242,25,SP$
52  570 REM TURN OFF THE VOICE
60  580 KOFF
D0  590 END
```

PROGRAM: MONSTER LDR

```
0B  100 REM ****************
6E  110 REM * MONSTER TALK *
7E  120 REM * BASIC LOADER *
31  130 REM *              *
BF  140 REM * BY MIKE BENN *
59  150 REM ****************
2F  160 REM
25  170 REM ****************
BE  180 REM *  DO NOT RUN  *
4C  190 REM *  UNLESS YOU  *
3D  200 REM *  HAVE RAISED *
E0  210 REM *  THE START   *
0E  220 REM *  OF BASIC    *
7F  230 REM *  SEE TEXT    *
9F  240 REM ****************
55  250 BL=201:LN=360:SA=2049
40  260 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15
6E  270 READ A:IF A>255THENPRINT
    "NUMBER TO LARGE";LN+(L*10):
    STOP
67  280 CX=CX+A:POKE SA+L*16+D,A
    :NEXT D
94  290 READ A:IF A><CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
83  300 NEXT L
7E  310 POKE43,1:POKE44,9:POKE45
    ,0:POKE46,21:SAVE"MONSTER TA
    LK",8,1
C4  320 REM *******************
    *********
63  330 REM *  TAPE USERS WILL N
    EED TO  *
C7  340 REM * CHANGE DEVICE NUMB
    ER TO 1 *
B2  350 REM *******************
    *********
43  360 DATA 36,8,195,7,158,50,4
    9,50,56,58,143,32,77,79,78,8
    3,1159
77  370 DATA 84,69,82,32,84,65,7
    6,75,47,77,73,75,69,32,66,69
    ,1075
50  380 DATA 78,78,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,156
D4  390 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
CE  400 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,169,169
E9  410 DATA 0,141,0,12,141,129,
    2,169,3,141,45,0,141,46,0,14
    1,1111
51  420 DATA 49,0,169,22,141,44,
    0,141,130,2,141,45,0,141,48,
    0,1075
69  430 DATA 169,1,141,43,0,0,0,
    170,170,170,170,170,170,170,
    170,85,1799
9D  440 DATA 85,85,85,85,85,85,8
    5,170,170,149,149,191,170,17
    0,170,170,2104
5B  450 DATA 170,170,149,149,191
    ,170,170,219,219,219,219,190
    ,190,170,170,102,2857
CC  460 DATA 153,102,153,102,153
    ,102,153,68,17,68,19,76,51,7
    6,51,92,1436
D7  470 DATA 83,92,115,76,115,20
    4,51,102,153,102,153,233,57,
    206,51,106,1896
14  480 DATA 154,106,154,106,154
    ,106,154,255,255,255,255,255
    ,255,252,252,119,3087
2C  490 DATA 221,119,153,102,170
    ,170,170,102,153,102,170,170
    ,170,170,170,68,2380
B0  500 DATA 17,68,145,164,169,1
    64,169,169,164,169,164,145,6
    8,17,68,68,1928
37  510 DATA 17,68,19,68,19,76,5
    1,196,19,196,19,196,19,196,1
    9,217,1395
B5  520 DATA 38,217,38,217,38,21
    7,38,255,255,255,0,85,85,255
    ,255,252,2500
2D  530 DATA 252,252,252,252,252
    ,252,252,255,255,255,255,255
    ,255,0,0,255,3549
3E  540 DATA 192,192,192,213,85,
    85,85,255,3,3,3,87,85,85,85,
    153,1803
A0  550 DATA 102,153,39,217,38,2
    01,50,106,154,106,154,102,15
    3,102,153,153,1982
64  560 DATA 102,153,102,154,106
    ,154,106,68,17,68,17,68,17,6
    8,17,206,1423
F8  570 DATA 49,198,57,230,25,23
    0,153,76,51,76,19,68,19,68,1
    7,149,1485
B9  580 DATA 149,191,170,170,170
    ,170,170,170,149,149,191,170
    ,170,170,170,85,2614
01  590 DATA 21,197,53,197,49,20
    5,49,204,51,204,51,204,51,20
    4,51,204,1995
A3  600 DATA 243,92,167,249,62,2
    07,51,204,51,204,243,125,150
    ,235,63,204,2550
83  610 DATA 55,217,110,191,243,
    204,51,204,51,207,125,150,23
    5,252,51,219,2565
71  620 DATA 54,246,54,246,54,21
    9,219,204,243,204,243,204,24
    3,204,51,0,2688
8D  630 DATA 0,0,0,0,0,0,0,92,16
    7,249,62,207,51,204,51,204,1
    287
3C  640 DATA 51,204,243,92,167,2
    49,62,255,255,92,167,249,254
    ,207,51,218,2815
1E  650 DATA 111,188,243,204,51,
    204,51,205,54,219,111,188,24
    3,204,51,108,2435
22  660 DATA 178,204,51,204,51,2
    04,51,204,51,204,51,255,255,
    0,255,0,2219
33  670 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
39  680 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
7B  690 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,5,0,5,85,95
6D  700 DATA 0,5,85,0,1,85,0,0,8
    5,0,0,0,0,0,0,0,261
18  710 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
01  720 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
C5  730 DATA 0,0,0,0,0,0,0,0,0,0
    ,80,0,0,85,80,0,245
11  740 DATA 85,80,0,85,64,0,85,
    0,0,0,0,0,0,0,0,0,399
77  750 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,52,0,52
69  760 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
6E  770 DATA 0,0,0,0,0,0,0,0,0,2
    1,0,1,85,0,5,123,235
2A  780 DATA 0,5,123,0,1,85,0,0,
    85,0,0,0,0,0,0,0,0,299
6A  790 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,255,0,255
8C  800 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
43  810 DATA 0,0,0,0,0,0,0,84,0,
    0,85,64,0,237,80,0,550
5B  820 DATA 189,80,0,85,84,0,85
    ,0,0,0,0,0,0,0,0,0,523
02  830 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
99  840 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
5B  850 DATA 0,0,0,0,0,0,21,0,0,
    91,0,1,123,0,5,170,411
BA  860 DATA 0,5,165,0,1,123,0,0
    ,85,0,0,0,0,0,0,0,379
14  870 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,54,0,54
5C  880 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
C3  890 DATA 0,0,0,0,84,0,0,229,
    0,0,237,64,0,170,80,0,864
97  900 DATA 90,80,0,189,64,0,85
    ,0,0,0,0,0,0,0,0,0,508
54  910 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,50,0,50
C8  920 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
08  930 DATA 0,0,0,5,0,0,23,0,0,
    91,0,1,106,0,5,170,401
74  940 DATA 0,5,170,0,5,251,0,1
    ,123,0,0,21,0,0,0,0,577
22  950 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,80,0,80
1C  960 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
7F  970 DATA 0,80,0,0,212,0,0,22
    8,0,0,169,64,0,170,80,0,1003
89  980 DATA 170,144,0,191,80,0,
    189,64,0,84,0,0,0,0,0,0,922
F2  990 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,204,0,204
7B  1000 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
69  1010 DATA 1,0,0,5,0,0,23,0,0
    ,27,0,0,106,0,1,170,333
D2  1020 DATA 0,1,170,0,0,123,0,
    0,27,0,0,21,0,0,0,0,342
4F  1030 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,17,0,17
D7  1040 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,64,0,64
2C  1050 DATA 0,80,0,0,212,0,0,2
    28,0,0,169,0,0,170,64,0,923
D3  1060 DATA 170,64,0,189,0,0,1
    80,0,0,84,0,0,0,0,0,0,587
23  1070 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,55,0,55
AF  1080 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
95  1090 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
83  1100 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
9B  1110 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,255,0,255
9E   1120 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,170,0,2,235,407
C4   1130 DATA 128,11,106,96,29,1
     10,249,199,106,125,45,234,23
     2,11,105,224,2010
DF   1140 DATA 2,247,128,0,170,0,
     0,0,0,0,2,0,0,0,0,0,547
AC   1150 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,197,170,357
F6   1160 DATA 170,170,170,170,17
     0,170,170,170,170,170,170,17
     0,170,170,170,170,2720
9C   1170 DATA 170,170,170,170,17
     0,170,170,170,170,170,170,17
     0,170,170,170,170,2720
A2   1180 DATA 170,170,170,170,17
     0,170,42,170,168,42,170,168,
     10,170,160,10,2130
75   1190 DATA 170,160,2,170,128,
     2,170,128,0,0,0,0,0,0,250,0,
     1180
63   1200 DATA 0,0,0,0,0,192,0,0,
     112,0,0,156,0,0,39,0,499
24   1210 DATA 0,9,192,0,2,112,0,
     0,144,0,0,50,0,0,220,0,729
5A   1220 DATA 3,103,0,13,137,192
     ,54,1,192,216,1,192,160,2,19
     2,0,1458
57   1230 DATA 0,112,0,0,176,0,0,
     156,0,0,39,0,0,10,234,0,727
30   1240 DATA 0,0,0,0,0,0,0,0,0,
     0,0,192,0,0,112,0,304
8E   1250 DATA 0,112,0,0,156,0,0,
     39,0,0,9,192,0,2,64,0,574
8A   1260 DATA 0,176,0,0,44,0,0,3
     9,0,0,9,0,0,1,192,0,461
AA   1270 DATA 2,112,0,0,144,0,0,
     44,0,0,39,0,0,9,190,0,540
56   1280 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,3,0,0,3
15   1290 DATA 13,0,0,13,0,0,54,0
     ,0,216,0,3,96,0,1,128,524
29   1300 DATA 0,14,0,0,56,0,0,21
     6,0,0,96,0,3,64,0,13,462
EF   1310 DATA 128,0,6,0,0,56,0,0
     ,216,0,0,96,0,0,251,0,753
14   1320 DATA 0,0,0,0,0,192,0,3,
     112,0,13,144,0,54,44,0,562
16   1330 DATA 216,39,3,96,9,205,
     128,2,118,0,0,156,0,0,55,0,1
     027
00   1340 DATA 0,217,192,3,99,112
     ,3,64,156,3,64,39,3,128,10,1
     3,1125
EC   1350 DATA 0,0,14,0,0,54,0,0,
     216,0,0,160,0,0,0,0,444
56   1360 DATA 0,76,75,14,76,51,1
     5,76,110,16,173,22,208,9,16,
     141,1278
AB   1370 DATA 22,208,169,18,141,
     24,208,169,9,141,34,208,169,
     12,141,32,1705
AC   1380 DATA 208,141,33,208,169
     ,5,141,35,208,160,0,185,176,
     16,153,0,1838
29   1390 DATA 4,185,175,17,153,0
     ,5,185,176,18,153,0,6,185,16
     8,19,1452
1B   1400 DATA 153,248,6,200,208,
     229,160,0,169,8,153,0,216,15
     3,0,217,2120
3E   1410 DATA 153,0,218,153,248,
     218,200,208,241,169,255,141,
     21,208,141,28,2602
9F   1420 DATA 208,169,3,141,23,2
     08,169,67,141,29,208,169,2,1
     41,37,208,1923
D9   1430 DATA 169,1,141,38,208,1
     69,0,141,39,208,141,40,208,1
     69,0,141,1813
D4   1440 DATA 41,208,141,42,208,
     141,43,208,141,44,208,141,46
     ,208,169,5,1994
C9   1450 DATA 141,45,208,169,135
     ,141,0,208,169,183,141,2,208
     ,169,162,141,2222
09   1460 DATA 1,208,141,3,208,16
     9,147,141,4,208,169,195,141,
     6,208,169,2118
CA   1470 DATA 124,141,5,208,141,
     7,208,169,220,141,8,208,169,
     90,141,9,1989
06   1480 DATA 208,169,135,141,10
     ,208,169,53,141,11,208,169,1
     60,141,12,208,2143
5F   1490 DATA 169,190,141,13,208
     ,169,120,141,14,208,169,94,1
     41,15,208,169,2169
52   1500 DATA 40,141,248,7,169,4
     1,141,249,7,169,51,141,250,7
     ,141,251,2053
51   1510 DATA 7,96,32,100,16,165
     ,20,141,78,8,32,253,174,32,1
     58,173,1486
C6   1520 DATA 32,166,182,141,78,
     8,165,34,133,100,165,35,133,
     101,160,0,1633
58   1530 DATA 177,100,153,160,20
     ,200,204,78,8,208,245,169,0,
     153,160,20,2055
89   1540 DATA 160,0,152,32,126,1
     5,168,152,32,126,15,168,185,
     160,20,240,1751
3C   1550 DATA 11,32,138,15,152,3
     2,126,15,168,200,208,230,96,
     162,200,172,1957
80   1560 DATA 79,8,136,208,253,2
     02,208,247,96,201,46,240,42,
     201,32,240,2439
8E   1570 DATA 51,201,66,240,47,2
     01,77,240,43,201,80,240,39,2
     01,70,240,2237
9A   1580 DATA 56,201,86,240,52,2
     01,79,240,95,201,85,240,120,
     201,87,240,2424
19   1590 DATA 116,201,90,240,112
     ,208,60,169,40,141,248,7,169
     ,41,141,249,2232
74   1600 DATA 7,76,54,16,169,40,
     141,248,7,169,41,141,249,7,1
     69,54,1588
97   1610 DATA 141,252,7,169,56,1
     41,253,7,96,169,42,141,248,7
     ,169,43,1941
E5   1620 DATA 141,249,7,169,54,1
     41,252,7,169,53,141,253,7,16
     9,1,141,1954
63   1630 DATA 34,208,96,169,44,1
     41,248,7,169,45,141,249,7,16
     9,51,141,1919
29   1640 DATA 250,7,141,251,7,76
     ,80,16,169,46,141,248,7,169,
     47,141,1796
52   1650 DATA 249,7,169,50,141,2
     50,7,141,251,7,169,53,141,25
     5,7,169,2068
F4   1660 DATA 52,141,254,7,96,16
     9,48,141,248,7,169,49,141,24
     9,7,169,1947
2F   1670 DATA 52,141,254,7,96,16
     9,50,141,250,7,141,251,7,141
     ,252,7,1966
74   1680 DATA 141,253,7,141,254,
     7,141,255,7,169,1,141,34,208
     ,96,169,2224
D6   1690 DATA 52,141,252,7,141,2
     53,7,141,254,7,141,255,7,169
     ,0,141,1975
E8   1700 DATA 34,208,96,32,253,1
     74,32,138,173,32,247,183,96,
     173,22,208,2101
AE   1710 DATA 41,239,141,22,208,
     169,20,141,24,208,169,0,141,
     21,208,169,1921
EE   1720 DATA 1,141,33,208,169,3
     ,141,32,208,169,6,141,134,2,
     169,147,1724
3F   1730 DATA 32,212,255,96,0,0,
     0,0,0,0,0,0,0,0,197,255,1045

2C   1740 DATA 11,255,191,217,253
     ,255,189,255,11,255,255,255,
     255,255,255,16,3183
49   1750 DATA 16,16,16,16,16,34,
     16,16,16,16,22,47,47,47,52,5
     3,446
76   1760 DATA 47,47,47,47,47,47,
     47,52,53,47,47,46,16,16,16,1
     6,638
F4   1770 DATA 16,16,34,16,16,16,
     16,16,16,16,16,16,16,34,16,1
     6,292
69   1780 DATA 16,22,47,47,47,42,
     19,27,27,27,27,27,27,27,27,1
     9,475
D8   1790 DATA 43,47,47,47,46,16,
     16,16,16,16,34,16,16,16,16,1
     6,424
AC   1800 DATA 16,16,16,16,16,34,
     16,16,16,47,47,47,42,40,15,1
     5,415
FC   1810 DATA 15,15,15,15,15,15,
     15,15,28,43,47,47,47,16,16,1
     6,383
A5   1820 DATA 16,16,34,16,16,16,
     16,16,16,16,16,16,16,34,16,1
     6,292
59   1830 DATA 16,47,47,47,20,39,
     45,15,17,15,18,15,17,15,45,1
     5,433
2E   1840 DATA 28,41,47,47,47,16,
     16,16,16,16,34,16,16,16,16,1
     6,425
C5   1850 DATA 16,16,16,16,16,34,
     16,16,16,47,47,47,20,40,15,1
     5,393
33   1860 DATA 15,15,15,15,15,15,
     15,15,28,41,47,47,47,16,16,1
     6,378
D8   1870 DATA 16,16,34,16,16,16,
     16,16,16,16,16,16,16,34,16,1
     6,292
A5   1880 DATA 16,47,47,47,20,15,
     15,15,15,15,15,15,15,15,15,1
     5,342
32   1890 DATA 15,41,47,47,47,16,
     16,16,16,16,34,16,16,16,16,1
     6,391
D5   1900 DATA 16,16,16,16,16,34,
     16,16,16,51,48,49,20,15,15,1
     5,375
80   1910 DATA 15,15,15,15,15,15,
     15,15,15,28,47,47,47,16,16,1
     6,352
2E   1920 DATA 16,16,34,16,16,16,
     16,35,25,35,35,35,35,35,35,3
     5,435
51   1930 DATA 35,47,47,47,20,15,
     15,15,15,15,15,15,15,15,15,1
     5,361
29   1940 DATA 15,15,48,49,50,35,
     25,35,35,35,35,35,35,35,35,1
     6,533
EF   1950 DATA 34,16,16,16,16,16,
     16,16,16,47,47,47,20,15,15,1
     5,368
30   1960 DATA 15,15,15,15,15,15,
     15,15,15,29,47,47,47,16,34,1
     6,371
4F   1970 DATA 16,16,16,16,16,16,
     16,16,34,16,16,16,16,16,16,1
     6,274
1C   1980 DATA 16,47,47,32,20,39,
     26,26,26,26,15,15,26,26,26,2
     6,439
AF   1990 DATA 29,41,31,47,47,16,
     34,16,16,16,16,16,16,16,16,1
     6,389
```

```
35  2000 DATA 34,16,16,16,16,15,
    16,16,16,47,47,32,20,20,15,1
    5,358
12  2010 DATA 15,15,15,15,15,15,
    15,15,41,41,31,47,47,16,34,1
    6,393
C5  2020 DATA 16,16,16,16,16,16,
    16,16,34,16,16,16,16,16,16,1
    6,274
8E  2030 DATA 16,47,47,32,20,40,
    27,27,27,27,15,15,20,27,27,2
    7,441
AC  2040 DATA 28,41,31,47,47,16,
    34,16,16,16,16,16,16,16,16,1
    6,389
16  2050 DATA 34,16,16,16,16,16,
    16,16,16,47,47,32,20,15,15,1
    5,353
7D  2060 DATA 15,15,24,15,20,15,
    15,15,15,41,31,47,47,16,34,1
    6,381
F2  2070 DATA 16,16,16,16,16,16,
    16,16,34,16,16,16,16,16,16,1
    6,274
47  2080 DATA 16,47,47,32,20,15,
    15,15,15,15,24,15,20,15,15,1
    5,341
20  2090 DATA 15,41,31,47,47,16,
    34,16,16,16,16,16,16,16,16,1
    6,375
55  2100 DATA 34,16,16,16,16,16,
    16,16,16,47,47,47,20,39,15,1
    5,392
15  2110 DATA 15,15,15,15,40,15,
    15,15,20,41,47,47,47,16,34,1
    6,422
87  2120 DATA 16,16,16,16,16,16,
    16,35,35,35,35,35,35,25,35,3
    5,417
67  2130 DATA 35,47,47,47,20,20,
    39,15,15,15,15,27,15,15,15,2
    9,416
C3  2140 DATA 41,41,47,47,47,35,
    35,35,35,35,25,35,35,35,35,1
    6,579
56  2150 DATA 15,16,15,16,16,34,
    16,15,15,47,47,47,38,20,20,1
    5,396
D6  2160 DATA 15,15,15,15,15,15,
    15,41,41,30,47,47,47,16,16,1
    6,406
DA  2170 DATA 16,16,34,16,16,16,
    16,16,16,16,16,16,16,34,16,1
    6,292
9A  2180 DATA 16,61,61,61,61,23,
    20,15,15,15,15,15,15,15,29,4
    1,478
91  2190 DATA 21,61,61,61,61,16,
    16,16,16,16,34,16,16,16,16,1
    6,459
05  2200 DATA 16,16,22,47,47,47,
    47,47,47,47,47,47,47,47,23,3
    9,633
B4  2210 DATA 15,15,15,15,15,29,
    41,21,47,47,47,47,47,47,52,5
    3,553
89  2220 DATA 47,47,47,46,16,16,
    16,16,16,57,56,47,47,47,47,4
    7,615
DA  2230 DATA 47,47,47,47,47,47,
    47,20,20,15,27,27,41,41,41,4
    7,608
4C  2240 DATA 47,47,47,47,47,47,
    52,53,47,47,47,47,46,16,16,1
    6,669
7A  2250 DATA 22,47,47,55,48,50,
    51,48,49,50,51,48,50,51,48,2
    0,735
40  2260 DATA 20,15,15,15,41,41,
    41,49,50,51,49,50,51,59,60,4
    7,654
CD  2270 DATA 47,47,47,47,47,46,
    16,22,47,47,47,47,47,47,47,4
    7,695
81  2280 DATA 47,47,47,47,47,47,
    47,20,20,15,15,15,41,41,41,4
    7,584
93  2290 DATA 47,47,47,47,47,47,
    47,47,47,47,47,47,47,47,46,4
    7,751
C9  2300 DATA 47,47,47,47,47,47,
    47,47,47,47,47,47,47,47,42,2
    0,720
2F  2310 DATA 20,15,15,15,41,41,
    41,43,47,47,47,47,47,47,47,4
    7,627
80  2320 DATA 47,47,47,47,47,47,
    47,47,47,47,47,47,47,47,47,4
    7,752
18  2330 DATA 47,47,47,47,47,42,
    20,20,20,15,15,15,41,41,41,4
    1,546
D1  2340 DATA 43,47,47,47,47,47,
    47,47,47,47,47,47,47,47,47,4
    7,748
CA  2350 DATA 47,47,47,47,47,47,
    47,47,47,47,47,47,42,20,20,2
    0,666
4F  2360 DATA 20,15,15,15,41,41,
    41,41,41,43,47,47,47,47,47,4
    7,595
A5  2370 DATA 47,47,47,47,47,47,
```

PROGRAM: MONSTER DEMO

```
21  100 REM ********************
    *****
88  110 REM *   MONSTER TALK DEM
    O   *
03  120 REM *      BY MIKE BENN
    *
0D  130 REM *
    *
F8  140 REM *  REMBER TO LOAD AN
    D   *
78  150 REM *  LOAD AND RUN MONS
    TER *
E4  160 REM *  TALK FIRST BEFORE
    *
E7  170 REM * LOADING DEMO PROGR
    AMS *
71  180 REM ********************
    *****
31  190 REM
8C  200 REM ********************
    *****
85  210 REM * THIS CAN BE RUN WI
    TH  *
D3  220 REM * THE CURRAH SPEECH
    64  *
CE  230 REM * BUT WILL NEED ADAP
    TING*
B7  240 REM * TO RUN WITH OTHER
    *
78  250 REM * SPEECH UNITS.
    *
80  260 REM ********************
    *****
B0  270 REM
BF  280 SA=3650
D4  290 INIT:REM INIALISE SPEECH
     UNIT
6F  300 SYSSA:REM GOTO MONSTER S
    CREEN
85  310 A$(1)="I SAY [(OO)N(LL)(
    EE)] WHAT MY MARSTER COMMAND
    S ME TO SAY. "
C0  320 A$(2)="MY LIPS MOVE IN L
    IPSINK TO MY VOICE BY ADJUST
    ING THE DELAY SETTING "
E5  330 A$(3)="IF MY MARSTER WIS
    HES I CAN BE PROGRAMMD TO TE
    LL THE TIME ON COMMAND "
EB  340 A$(4)="I FEEL TIRED NOW
    MARSTER I SHALL SLEEP UNTIL
    YOU NEXT COMMAND ME "
EF  350 REM SAYA$(X) = TELL YOUR
     SPEECH UNIT TO SPEAK A$(X)
87  360 SAYA$(1)
30  370 DE=20
44  380 GOSUB510
0C  390 SAYA$(2)
EE  400 DE=24
AA  410 GOSUB510
A9  420 SAYA$(3)
80  430 DE=24
88  440 GOSUB510
4A  450 SAYA$(4)
9A  460 DE=24
EE  470 GOSUB510
EE  480 SYSSA+6:REM GO BACK TO B
    ASIC
35  490 KOFF:TURN OFF SPEECH UNI
    T
75  500 END
97  510 SYSSA+3,DE,A$(X):RETURN
```

CONSTRUCTING A COMPILER

PROGRAM: SYSLIB.LDR

```
7E  10 AD=49152
38  20 FOR LN=100 TO 2130 STEP 1
    0
A3  25 :  RT=0
91  30 :  FOR OS=0 TO 15
C2  35 :      READ BY:POKE AD+OS,
    BY
4D  40 :      RT=RT+BY
99  45 :  NEXT
C8  50 :  READ TT:IF RT<>TT THEN
     PRINT "ERROR IN LINE";LN:EN
    D
2A  55 :  AD=AD+16
BE  60 NEXT
12  65 HI=INT(AD/256):LO=AD-HI*2
    56
CC  70 POKE 43,0:POKE 44,192:POK
    E 45,LO:POKE 46,HI:SAVE"SYSL
    IB",8
D7  75 CLR
31  100 DATA 169,76,162,32,160,1
    92,133,94,134,95,132,96,169,
    255,162,154, 2215
00  110 DATA 133,73,134,74,165,4
    5,166,46,133,78,134,79,32,21
    ,198,96, 1607
A0  120 DATA 10,170,189,49,192,1
    41,47,192,189,50,192,141,48,
    192,76,0, 1878
A0  130 DATA 0,224,192,133,198,1
    77,199,214,198,223,198,25,20
    0,75,200,47, 2503
11  140 DATA 203,54,203,60,203,7
    5,203,84,203,69,203,243,202,
    19,204,54, 2282
2C  150 DATA 204,166,200,197,199
    ,210,199,53,201,69,201,93,20
    1,121,201,153, 2668
E1  160 DATA 201,165,201,177,201
    ,192,201,207,201,233,201,164
    ,199,188,199,3, 2933
3F  170 DATA 202,247,202,117,200
    ,124,200,155,199,9,202,118,2
    04,127,204,141, 2651
15  180 DATA 204,160,204,215,199
    ,50,202,220,199,153,200,232,
    198,245,198,2, 2891
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FD  190 DATA 199,15,199,37,199,6
    1,199,107,199,93,199,67,199,
    99,199,113, 2184
87  200 DATA 199,134,199,185,200
    ,4,201,207,192,207,192,133,2
    00,144,200,223, 2820
ED  210 DATA 199,103,202,122,202
    ,232,199,241,199,16,200,14,2
    02,90,203,125, 2549
FA  220 DATA 203,181,203,155,202
    ,6,202,76,204,94,204,255,203
    ,208,192,95, 2582
C0  230 DATA 32,204,255,169,15,3
    2,195,255,32,231,255,162,128
    ,108,0,3, 2076
B5  240 DATA 128,252,255,206,85,
    77,69,82,73,67,32,207,85,69,
    82,70, 1820
24  250 DATA 76,79,87,0,206,85,7
    7,69,82,73,67,32,213,78,68,6
    9, 1361
AB  260 DATA 82,70,76,79,87,0,21
    5,193,210,206,201,206,199,58
    ,32,195, 2110
65  270 DATA 73,83,75,32,78,79,8
    4,32,80,82,69,83,69,78,84,46
    , 1127
27  280 DATA 32,211,85,66,83,69,
    81,85,69,78,84,32,32,32,201,
    47, 1287
2A  290 DATA 207,32,65,84,84,69,
    77,80,84,83,32,87,73,76,76,3
    2, 1241
7F  300 DATA 67,65,85,83,69,32,5
    8,82,82,79,82,83,227,192,244
    ,192, 1733
A7  310 DATA 6,193,208,82,79,71,
    82,65,77,32,195,65,78,78,79,
    84, 1474
5E  320 DATA 32,195,79,78,84,73,
    78,85,69,0,194,65,68,32,193,
    82, 1407
47  330 DATA 82,65,89,32,211,85,
    66,83,67,82,73,80,84,0,201,7
    6, 1375
F3  340 DATA 75,69,71,65,76,32,2
    09,85,65,78,84,73,84,89,0,21
    1, 1367
83  350 DATA 84,82,73,78,71,32,2
    12,79,79,32,204,79,78,71,0,1
    96, 1450
61  360 DATA 65,84,65,32,212,89,
    80,69,32,205,73,83,77,65,84,
    67, 1382
5E  370 DATA 72,0,211,89,83,84,5
    9,77,32,201,47,207,32,69,82,
    82, 1437
4E  380 DATA 79,82,0,210,69,83,5
    9,82,85,69,68,32,201,47,207,
    32, 1416
A7  390 DATA 195,72,65,78,78,69,
    76,0,196,69,86,73,67,69,32,7
    8, 1303
FD  400 DATA 79,84,32,70,79,85,7
    8,68,0,206,85,76,76,32,199,2
    01, 1449
E2  410 DATA 195,0,207,85,84,32,
    79,70,32,205,69,77,79,82,89,
    0, 1396
B2  420 DATA 196,73,86,73,83,73,
    79,78,32,66,89,32,90,69,82,7
    9, 1280
5D  430 DATA 0,211,84,65,67,75,3
    2,79,86,69,82,70,76,79,87,0,
     1162
F3  440 DATA 82,193,105,193,125,
    193,143,193,159,192,178,193,
    195,193,216,193, 2749
EC  450 DATA 233,193,242,193,0,1
    94,17,194,138,72,32,204,255,
    104,72,32, 2175
41  460 DATA 210,199,104,72,10,1
    70,189,33,194,168,189,32,194
    ,170,32,96, 2062
F6  470 DATA 195,169,13,32,210,2
    55,104,240,5,169,0,76,67,194
    ,76,208, 2013
88  480 DATA 192,138,10,170,189,
    77,193,168,189,76,193,170,32
    ,96,195,169, 2257
C4  490 DATA 13,76,210,255,72,32
    ,204,255,104,10,170,189,75,1
    95,168,189, 2217
F6  500 DATA 74,195,170,32,95,19
    5,169,13,32,210,255,162,5,76
    ,56,194, 1934
24  510 DATA 211,212,207,208,69,
    68,0,212,79,79,32,77,65,78,8
    9,32, 1718
88  520 DATA 79,80,69,78,32,70,7
    3,76,69,83,0,198,73,76,69,32
    , 1157
8E  530 DATA 65,76,82,69,65,68,8
    9,32,79,80,69,78,0,198,73,76
    , 1199
3C  540 DATA 69,32,78,79,84,32,7
    9,80,69,78,0,198,73,76,69,32
    , 1129
76  550 DATA 78,79,84,32,70,79,8
    5,78,68,0,196,69,86,73,67,69
    , 1213
37  560 DATA 32,78,79,84,32,80,8
    2,69,83,69,78,84,0,198,73,76
    , 1197
F8  570 DATA 69,32,73,83,32,78,7
    9,84,32,65,78,32,201,206,208
    ,213, 1565
AE  580 DATA 212,32,70,73,76,69,
    0,198,73,76,69,32,73,83,32,7
    8, 1245
5C  590 DATA 79,84,32,65,78,32,2
    07,213,212,208,213,212,32,70
    ,73,76, 1885
CA  600 DATA 69,0,198,73,76,69,3
    2,78,65,77,69,32,77,73,83,83
    , 1154
1F  610 DATA 73,78,71,0,201,76,7
    6,69,71,65,76,32,196,69,86,7
    3, 1312
2D  620 DATA 67,69,32,78,85,77,6
    6,69,82,0,144,194,151,194,17
    1,194, 1673
8F  630 DATA 189,194,202,194,218
    ,194,237,194,7,195,34,195,52
    ,195,134,196, 2631
69  640 DATA 134,71,132,72,160,0
    ,177,71,240,6,32,210,255,200
    ,208,246, 2214
BE  650 DATA 96,0,0,16,5,232,1,1
    00,0,10,0,169,0,141,114,195,
     1079
D7  660 DATA 141,113,195,170,160
    ,0,56,200,165,71,253,115,195
    ,133,71,165, 2203
C3  670 DATA 72,253,116,195,133,
    72,176,239,136,165,71,125,11
    5,195,132,71, 2267
F2  680 DATA 165,72,125,116,195,
    133,72,152,208,7,172,113,195
    ,240,17,208, 2190
A1  690 DATA 3,140,113,195,9,48,
    172,114,195,153,0,155,200,14
    0,114,195, 1946
33  700 DATA 232,232,224,8,208,1
    90,165,71,9,48,172,114,195,1
    53,0,155, 2176
25  710 DATA 200,169,0,153,0,155
    ,96,0,0,0,0,0,0,0,0,0, 773
D5  720 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,162,0,134, 295
FC  730 DATA 5,134,6,189,215,195
    ,208,1,96,32,73,196,144,58,2
    32,41, 1825
1E  740 DATA 15,72,165,6,72,165,
    5,72,6,5,38,6,176,39,6,5, 85
    3
90  750 DATA 38,6,176,33,24,104,
    101,5,133,5,104,101,6,133,6,
    176, 1151
45  760 DATA 20,6,5,38,5,176,14,
    104,24,101,5,133,5,165,6,125
    , 913
2E  770 DATA 0,133,6,144,190,162
    ,2,44,162,4,76,56,194,201,65
    ,144, 1583
32  780 DATA 6,201,91,176,2,56,9
    6,24,95,201,48,144,250,201,5
    8,176, 1826
45  790 DATA 246,144,242,32,61,1
    96,144,1,96,76,73,196,108,94
    ,195,160, 2064
0E  800 DATA 0,32,228,255,201,13
    ,240,18,170,32,183,255,208,1
    2,138,153, 2138
02  810 DATA 0,156,200,208,235,1
    62,3,76,56,194,169,0,153,0,1
    56,140, 1909
8D  820 DATA 236,195,141,235,195
    ,96,160,0,32,207,255,201,13,
    240,11,153, 2370
2C  830 DATA 0,156,200,208,243,1
    62,3,76,56,194,169,0,153,0,1
    55,140, 1915
EA  840 DATA 236,195,141,235,195
    ,76,210,199,0,172,235,195,20
    4,236,195,144, 2868
C1  850 DATA 6,32,92,196,24,144,
    242,162,0,185,0,156,201,32,2
    08,8, 1588
48  860 DATA 173,160,196,208,6,2
    00,208,241,141,158,196,32,93
    ,195,144,7, 2367
85  870 DATA 157,215,195,200,232
    ,208,226,200,140,235,195,169
    ,0,157,215,195, 2939
AF  880 DATA 96,174,235,195,236,
    236,195,144,6,32,92,195,24,1
    44,242,160, 2407
EC  890 DATA 0,189,0,156,240,15,
    201,44,240,11,145,78,232,200
    ,208,241, 2200
96  900 DATA 162,3,76,56,194,232
    ,142,235,195,76,128,197,0,0,
    0,165, 1861
50  910 DATA 38,24,101,63,144,5,
    162,3,76,56,194,24,101,78,17
    0,165, 1404
32  920 DATA 79,105,0,197,74,144
    ,25,240,19,173,12,197,240,5,
    162,9, 1681
DF  930 DATA 76,56,194,238,12,19
    7,32,151,197,76,15,197,228,7
    3,176,233, 2151
FB  940 DATA 160,0,140,12,197,14
    0,13,197,140,14,197,172,13,1
    97,196,38, 1826
A6  950 DATA 240,14,177,38,200,1
    40,13,197,172,14,197,145,78,
    200,208,232, 2266
2C  960 DATA 160,0,140,13,197,17
    2,13,197,196,63,240,17,177,6
    4,200,140, 1989
BE  970 DATA 13,197,172,14,197,1
    45,78,200,140,14,197,228,232
    ,172,14,197, 2190
8E  980 DATA 132,63,165,78,166,7
    9,133,64,134,65,152,24,101,7
    8,133,78, 1645
CD  990 DATA 165,79,105,0,133,79
    ,96,96,64,48,58,32,32,32,32,
    32, 1083
2E  1000 DATA 32,32,32,32,32,32,
    32,32,32,32,32,32,32,32,32,3
    2, 512
7D  1010 DATA 32,44,83,44,92,165
    ,252,208,23,165,63,240,22,16
    5,251,240, 2079
54  1020 DATA 15,201,1,242,20,20
    1,15,240,16,165,63,201,17,17
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   6,7,96, 1674
E3 1030 DATA 162,2,44,162,8,44,
   162,3,44,162,6,76,56,194,160
   ,0, 1285
62 1040 DATA 162,3,177,64,157,1
   52,197,200,232,198,63,144,24
   5,160,0,185, 2337
4C 1050 DATA 177,197,157,152,19
   7,232,200,192,4,144,244,173,
   180,197,201,87, 2734
AD 1060 DATA 240,8,138,162,155,
   160,197,76,189,255,232,232,2
   32,138,162,152, 2728
E0 1070 DATA 160,197,76,189,255
   ,169,15,168,162,8,32,186,255
   ,169,1,162, 2204
B4 1080 DATA 56,160,198,32,189,
   255,32,192,255,176,1,96,201,
   5,240,3, 2091
A4 1090 DATA 76,116,194,162,2,7
   6,97,194,73,162,15,32,198,25
   5,144,3, 1798
58 1100 DATA 72,116,194,160,0,3
   2,228,255,201,13,240,6,153,9
   0,198,200, 2162
C0 1110 DATA 208,243,169,0,153,
   90,198,76,204,255,0,0,0,0,0,
   0, 1596
17 1120 DATA 0,0,0,0,0,0,0,0,0,
   0,0,0,0,0,0,0, 0
1D 1130 DATA 0,0,0,0,0,0,0,0,0,
   0,0,0,0,0,0,0, 0
0A 1140 DATA 0,0,0,157,0,173,13
   0,198,174,131,198,133,71,134
   ,72,24, 1595
59 1150 DATA 105,2,141,130,198,
   138,105,0,141,131,198,238,13
   2,198,208,5, 2070
2E 1160 DATA 162,11,76,56,194,1
   60,0,165,5,145,71,200,165,6,
   145,71, 1632
CC 1170 DATA 96,173,130,198,174
   ,131,198,56,233,2,141,130,19
   8,133,71,138, 2202
9C 1180 DATA 233,0,141,131,198,
   133,72,206,132,198,160,1,177
   ,71,133,4, 1990
D1 1190 DATA 136,177,71,133,3,9
   6,165,5,166,6,133,251,134,25
   2,96,165, 1989
C8 1200 DATA 5,166,6,133,253,13
   4,254,96,165,3,5,5,133,5,165
   ,4, 1532
5F 1210 DATA 5,6,133,6,96,165,3
   ,69,5,133,5,165,4,69,6,133,
   1003
FF 1220 DATA 6,96,165,3,37,5,13
   3,5,165,4,37,6,133,6,96,165,
    1062
ED 1230 DATA 5,166,6,201,0,208,
   7,224,0,208,3,230,5,96,169,0
   , 1529
68 1240 DATA 133,5,133,6,96,165
   ,5,197,3,208,9,165,6,197,4,2
   08, 1540
AC 1250 DATA 3,169,1,44,169,0,1
   62,0,133,5,134,6,96,32,37,19
   9, 1190
27 1260 DATA 76,15,199,165,4,19
   7,6,144,8,208,9,165,3,197,5,
   176, 1577
07 1270 DATA 3,169,1,44,169,0,1
   62,0,133,5,134,6,96,32,67,19
   9, 1220
60 1280 DATA 76,15,199,32,93,19
   9,201,0,240,211,96,32,99,199
   ,76,15, 1783
83 1290 DATA 199,165,5,24,101,3
   ,133,5,165,4,101,6,133,6,176
   ,1, 1227
43 1300 DATA 96,162,0,76,97,194
   ,165,3,56,229,5,133,5,165,4,
   229, 1619
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DE 1310 DATA 6,133,6,144,1,96,1
   62,1,76,97,194,165,5,201,0,2
   08, 1495
3D 1320 DATA 2,165,5,96,165,3,7
   2,165,4,72,32,177,198,165,3,
   133, 1458
AD 1330 DATA 69,165,4,133,70,10
   4,133,4,104,133,3,96,165,5,1
   66,6, 1360
B4 1340 DATA 133,69,134,70,96,1
   60,0,177,64,32,210,255,200,1
   96,63,208, 2067
1E 1350 DATA 246,96,169,13,76,2
   10,255,169,147,76,210,255,76
   ,208,192,165, 2563
00 1360 DATA 63,133,5,169,0,133
   ,6,96,160,0,177,64,133,5,132
   ,6, 1282
4B 1370 DATA 96,32,225,255,240,
   7,169,0,133,5,133,6,96,169,1
   ,162, 1729
D6 1380 DATA 0,133,5,134,6,96,3
   2,183,255,133,5,169,0,133,6,
   96, 1386
24 1390 DATA 32,228,255,133,5,1
   69,0,133,6,96,173,130,198,17
   4,131,198, 2061
9E 1400 DATA 133,71,134,72,24,1
   05,3,141,130,198,138,105,0,1
   41,131,198, 1724
86 1410 DATA 238,132,198,208,5,
   162,11,76,56,194,160,0,165,6
   3,145,71, 1884
9B 1420 DATA 200,165,64,145,71,
   200,165,65,145,71,96,173,130
   ,198,174,131, 2193
44 1430 DATA 198,56,233,3,141,1
   30,198,133,71,138,233,0,141,
   131,198,133, 2137
98 1440 DATA 72,206,132,198,160
   ,2,177,71,133,40,136,177,71,
   133,39,136, 1883
A2 1450 DATA 177,71,133,38,96,1
   60,0,165,251,145,3,96,32,117
   ,200,200, 1884
B1 1460 DATA 165,252,145,3,96,1
   60,0,177,251,133,5,169,0,133
   ,6,96, 1791
AE 1470 DATA 32,133,200,200,177
   ,251,133,6,96,165,5,141,164,
   200,165,6, 2074
66 1480 DATA 141,165,200,76,0,0
   ,165,5,166,6,133,71,134,72,3
   2,123, 1489
42 1490 DATA 195,162,0,160,155,
   76,96,195,0,164,5,165,6,208,
   5,192, 1765
E3 1500 DATA 0,208,1,96,165,3,1
   33,5,165,4,133,6,136,192,255
   ,208, 1710
8D 1510 DATA 1,202,192,0,208,5,
   224,0,208,1,96,165,5,24,101,
   3, 1425
44 1520 DATA 133,5,165,6,101,4,
   133,6,144,225,173,184,200,20
   8,221,169, 2079
73 1530 DATA 1,141,184,200,138,
   72,152,72,162,0,32,87,194,10
   4,168,104, 1921
34 1540 DATA 170,24,144,200,184
   ,5,166,6,208,2,192,0,208,5,1
   62,10, 1673
54 1550 DATA 76,56,194,162,0,16
   0,0,232,208,1,200,165,3,56,2
   29,5, 1747
92 1560 DATA 133,3,165,4,229,6,
   133,4,176,237,202,224,255,20
   8,1,136, 2116
E2 1570 DATA 134,5,132,6,96,165
   ,202,41,7,73,7,168,169,29,32
   ,210, 1476
2C 1580 DATA 255,136,16,248,96,
   160,1,165,70,209,71,176,1,96
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   ,208,8, 1916
1A 1590 DATA 136,165,69,209,71,
   176,1,96,162,1,76,56,194,166
   ,71,164, 1813
EE 1600 DATA 72,232,208,1,200,2
   32,208,1,200,6,69,38,70,138,
   24,101, 1800
EF 1610 DATA 69,133,71,152,101,
   70,133,72,96,166,71,164,72,2
   32,208,1, 1811
9D 1620 DATA 200,232,208,1,200,
   6,69,38,70,6,69,38,70,138,24
   ,101, 1470
17 1630 DATA 69,133,71,152,101,
   70,133,72,96,162,0,177,71,13
   3,5,202, 1543
42 1640 DATA 177,71,133,5,96,16
   0,0,165,5,145,71,200,165,6,1
   45,71, 1516
E7 1650 DATA 96,160,0,162,0,177
   ,71,149,53,200,232,192,3,208
   ,246,96, 2055
AE 1660 DATA 160,0,162,0,181,63
   ,145,71,200,232,192,3,208,24
   6,96,160, 2119
7C 1670 DATA 0,177,71,24,105,1,
   145,71,8,200,40,177,71,105,0
   ,145, 1340
18 1680 DATA 71,176,1,96,162,0,
   76,97,194,160,0,177,71,56,23
   3,1, 1571
D8 1690 DATA 145,71,8,200,40,17
   7,71,105,0,145,71,144,1,96,1
   62,1, 1437
3E 1700 DATA 76,97,194,32,189,1
   95,76,237,195,165,5,76,210,2
   55,165,6, 2154
1E 1710 DATA 240,5,162,2,76,56,
   194,165,5,240,20,170,32,198,
   255,144, 1954
9E 1720 DATA 2,76,116,194,32,22
   8,255,72,32,204,255,104,133,
   5,96,32, 1837
71 1730 DATA 229,255,201,0,240,
   249,133,5,96,0,0,0,120,165,1
   65,24, 1881
13 1740 DATA 101,5,141,59,202,1
   65,164,101,6,141,58,202,165,
   163,105,0, 1778
79 1750 DATA 141,57,202,88,162,
   0,181,163,221,57,202,144,249
   ,240,1,96, 2204
FD 1760 DATA 232,224,3,208,241,
   240,237,160,0,165,6,240,5,16
   2,2,76, 2201
33 1770 DATA 56,194,165,5,145,7
   8,230,78,128,197,165,5,166,6
   ,133,71, 1790
FB 1780 DATA 134,72,32,123,195,
   160,0,162,0,189,0,155,240,6,
   145,78, 1691
A9 1790 DATA 232,200,208,245,76
   ,128,197,0,0,0,0,165,5,166,6
   ,141, 1769
1F 1800 DATA 209,202,142,210,20
   2,160,0,162,0,196,63,240,11,
   177,64,157, 2195
5E 1810 DATA 151,202,200,232,19
   2,4,208,241,165,62,201,4,144
   ,7,173,154, 2341
2D 1820 DATA 202,72,24,144,1,8,
   173,151,202,174,152,202,172,
   153,202,40, 2072
06 1830 DATA 32,0,0,141,151,202
   ,142,152,202,140,153,202,8,1
   04,141,154, 1924
95 1840 DATA 202,160,0,162,0,18
   9,151,202,145,78,232,200,192
   ,4,208,245, 2370
33 1850 DATA 76,128,197,32,15,1
   97,96,32,225,196,96,160,0,19
   6,63,208, 1917
89 1860 DATA 7,196,38,208,3,169
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```
       ,0,96,186,53,208,4,24,169,1,
       96, 1478
7C     1870 DATA 195,38,208,4,55,16
       9,1,96,177,64,55,241,39,240,
       1,96, 1582
A1     1880 DATA 200,208,218,169,0,
       44,169,1,162,0,133,5,134,6,9
       6,32, 1577
8E     1890 DATA 251,202,240,242,20
       8,237,32,47,203,76,15,199,32
       ,251,202,240, 2577
24     1900 DATA 229,176,227,144,22
       2,32,60,203,76,15,199,32,251
       ,202,240,214, 2522
9D     1910 DATA 144,212,176,207,32
       ,251,202,76,15,199,165,6,240
       ,5,162,2, 2094
8D     1920 DATA 76,56,194,165,5,19
       7,63,144,4,165,63,133,5,160,
       0,196, 1626
5A     1930 DATA 5,240,7,177,64,145
       ,78,200,208,245,76,128,197,1
       65,6,240, 2181
82     1940 DATA 5,162,2,76,56,194,
       165,5,197,63,144,4,165,63,13
       3,5, 1439
5A     1950 DATA 165,63,56,229,5,14
       1,13,197,160,0,140,14,197,19
       6,5,240, 1821
1C     1960 DATA 17,172,13,197,177,
       64,200,140,13,197,172,14,197
       ,145,78,200, 1996
3D     1970 DATA 208,232,76,128,197
       ,165,252,242,5,162,2,76,56,1
       94,165,254, 2412
F8     1980 DATA 208,247,165,251,19
       7,63,144,4,165,63,133,251,16
       5,63,56,229, 2404
24     1990 DATA 251,133,71,165,253
       ,197,71,144,4,165,71,133,253
       ,165,251,141, 2469
66     2000 DATA 13,197,160,0,140,1
       4,197,196,253,240,17,172,13,
       197,177,64, 2050
EF     2010 DATA 200,140,13,197,172
       ,14,197,145,78,200,208,232,7
       6,128,197,32, 2229
64     2020 DATA 204,255,169,0,141,
       18,204,169,134,162,196,141,9
       4,195,142,95, 2319
DE     2030 DATA 195,96,0,165,6,240
       ,5,162,2,76,56,194,166,5,32,
       198, 1598
53     2040 DATA 255,176,16,165,5,1
       41,18,204,169,95,162,196,141
       ,94,195,142, 2174
E6     2050 DATA 95,195,96,76,116,1
       94,165,6,240,5,162,2,76,55,1
       94,166, 1844
31     2060 DATA 5,32,201,255,176,2
       37,165,5,141,18,204,96,32,57
       ,198,160, 1982
E8     2070 DATA 0,185,90,198,240,5
       ,145,78,200,208,245,76,129,1
       97,32,57, 2285
A9     2080 DATA 198,152,0,185,90,1
       98,153,215,195,200,192,2,208
       ,245,169,0, 2410
65     2090 DATA 153,215,195,76,237
       ,195,32,192,255,176,1,96,75,
       116,194,165, 2374
9C     2100 DATA 6,240,5,162,2,76,5
       6,194,165,5,76,195,255,32,18
       1,197, 1847
2F     2110 DATA 169,82,141,180,197
       ,165,251,168,162,8,32,186,25
       5,76,222,197, 2491
28     2120 DATA 32,181,197,169,87,
       141,182,197,165,251,168,162,
       8,32,186,255, 2411
FF     2130 DATA 76,222,197,0,0,0,0
       ,0,0,0,0,0,0,0,0,0, 495
```

WILLIAM TELL

Here are the first two parts of William Tell which will build up over the next few months into the full program. These parts will not run individually so, after you type them in, save them onto a tape or disk and keep it safe. The final installment will contain full instructions on what to do to bring all of the parts together.

PROGRAM: WT1.BAS

```
26   10 BL=404:LN=50:SA=34048
F9   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15
8E   21 READ A:POKE53280,A
9E   22 CX=CX+A:POKE SA+L*16+D,A:
     NEXT
A2   30 READA:IF A=CX THEN40
12   31 PRINT"ERROR IN LINE";LN+(
     L*10):STOP
12   40 NEXT L:SYS40352
69   50 DATA 32,82,37,37,37,37,37
     ,37,60,32,32,32,32,32,82,37,
     675
C8   60 DATA 37,37,37,37,32,82,37
     ,37,37,37,37,37,58,32,32,32,
     639
EF   70 DATA 32,32,82,81,45,45,45
     ,45,32,82,37,37,37,37,37,37,
     743
44   80 DATA 58,32,32,32,32,32,82
     ,81,46,40,40,46,32,82,37,83,
     787
2E   90 DATA 40,84,37,37,60,32,32
     ,32,32,32,82,81,39,39,39,39,
     737
C4   100 DATA 32,82,37,37,37,37,3
     7,37,37,58,32,32,32,32,30,27
     ,616
C1   110 DATA 47,47,47,47,32,82,3
     7,37,83,40,84,37,37,60,32,32
     ,781
E7   120 DATA 32,32,32,30,27,37,3
     7,37,32,82,37,37,37,37,37,37
     ,600
D5   130 DATA 37,37,60,32,32,32,3
     2,32,30,27,37,37,32,82,37,46
     ,622
FC   140 DATA 37,83,40,84,37,37,6
     0,32,32,32,32,32,32,30,27,37
     ,664
EA   150 DATA 32,82,37,46,37,37,3
     7,37,37,37,37,60,32,32,32,32
     ,644
E7   160 DATA 32,32,30,27,32,82,8
     2,46,46,37,83,40,84,37,37,60
     ,787
5E   170 DATA 32,32,32,32,32,32,3
     2,75,32,32,82,37,46,46,37,37
     ,648
DD   180 DATA 37,37,37,58,32,32,3
     2,32,32,32,32,75,32,32,82,37
     ,651
7E   190 DATA 37,37,37,37,37,37,5
     8,32,32,32,32,32,32,32,32,75
     ,611
95   200 DATA 32,32,32,82,37,37,3
     7,37,37,58,32,32,32,32,32,32
     ,613
25   210 DATA 32,32,32,75,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,555
13   220 DATA 32,32,32,32,32,32,3
     2,75,32,32,32,32,32,32,32,32
     ,555
59   230 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,75,32,32,32,32
     ,555
D7   240 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,75
     ,555
EF   250 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,512
44   260 DATA 32,32,32,75,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,555
C2   270 DATA 32,32,32,32,32,32,3
     2,75,32,32,32,32,32,32,32,32
     ,555
D8   280 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,75,32,32,32,32
     ,555
35   290 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,75
     ,555
CE   300 DATA 32,32,32,32,32,32,8
     8,32,32,32,32,32,32,32,32,32
     ,568
39   310 DATA 32,32,32,29,32,32,3
     2,32,32,32,89,32,32,32,32,32
     ,566
9A   320 DATA 32,32,32,32,32,32,3
     2,29,32,32,32,32,32,32,32,32
     ,509
C1   330 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,29,32,32,28,60
     ,533
9F   340 DATA 32,32,32,32,32,28,5
     0,32,32,32,32,32,32,32,32,29
     ,533
92   350 DATA 32,59,29,60,32,32,3
     2,32,32,29,58,32,32,32,32,32
     ,587
CA   360 DATA 32,32,32,29,32,32,2
     9,58,32,32,32,32,32,34,34,34
     ,539
37   370 DATA 34,34,34,34,34,34,3
     4,28,32,62,29,43,32,32,32,32
     ,561
8A   380 DATA 32,35,35,35,35,35,3
     5,35,35,35,35,29,32,32,29,60
     ,564
8D   390 DATA 32,32,32,32,32,29,6
     0,32,32,32,32,32,32,32,32,29
     ,534
F8   400 DATA 32,32,34,34,34,34,3
     4,34,34,28,58,32,32,32,32,32
     ,549
7C   410 DATA 32,32,59,28,32,32,3
     5,35,35,35,35,35,35,28,60,32
     ,582
53   420 DATA 32,32,32,32,32,32,6
     2,29,32,32,29,60,32,32,32,32
     ,564
9D   430 DATA 32,29,58,32,32,32,2
     8,60,32,32,32,29,32,59,29,58
     ,606
EC   440 DATA 32,32,32,32,62,29,6
     0,32,32,32,29,78,32,32,59,29
     ,534
45   450 DATA 32,32,29,60,32,32,3
     2,32,32,36,58,32,32,59,29,58
     ,617
56   460 DATA 32,32,32,29,32,62,2
     9,58,32,32,32,32,32,32,32,32
     ,562
CE   470 DATA 32,32,29,78,32,32,3
     2,29,32,32,29,60,32,32,32,32
     ,577
```

```
B5   480 DATA 32,32,32,32,32,62,2
     9,43,32,32,32,29,32,32,29,58
     ,570
F5   490 DATA 32,32,32,32,32,32,3
     2,32,32,32,41,58,32,32,32,29
     ,544
44   500 DATA 32,32,29,32,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,509
28   510 DATA 32,32,32,29,32,32,2
     9,43,32,32,32,32,32,32,32,32
     ,517
CF   520 DATA 32,32,32,32,32,32,5
     9,29,32,32,29,60,32,32,32,32
     ,561
D7   530 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,29,32,59,29,60
     ,561
42   540 DATA 32,32,32,32,32,32,3
     2,32,32,32,29,60,32,32,32,29
     ,533
92   550 DATA 32,32,29,58,32,32,3
     2,32,32,32,32,32,88,32,29,60
     ,616
A4   560 DATA 32,32,32,29,32,62,2
     9,60,32,32,32,32,32,32,32,32
     ,564
03   570 DATA 89,32,29,60,32,32,3
     2,29,32,32,29,58,32,32,32,32
     ,614
B4   580 DATA 32,32,32,32,32,32,2
     9,60,32,32,32,29,32,32,29,60
     ,559
D8   590 DATA 32,32,32,32,32,29,5
     0,32,32,59,29,58,32,32,32,29
     ,593
89   600 DATA 32,32,29,60,32,22,3
     2,32,59,29,58,32,32,32,29,60
     ,612
7D   610 DATA 32,32,32,29,32,32,3
     4,34,34,34,34,34,34,29,60,32
     ,548
FE   620 DATA 32,32,29,60,32,32,3
     2,29,32,32,35,35,35,35,35,35
     ,552
7C   630 DATA 35,29,58,32,32,62,2
     9,58,32,32,32,29,32,32,29,60
     ,613
7A   640 DATA 32,32,32,32,32,29,5
     0,32,32,32,29,60,32,32,32,29
     ,559
F7   650 DATA 32,59,29,60,32,32,3
     2,32,62,29,60,32,32,32,29,58
     ,642
1F   660 DATA 32,32,32,29,32,32,2
     9,58,32,32,32,32,32,34,34,34
     ,538
93   670 DATA 34,34,29,60,32,32,3
     2,29,32,62,29,60,32,22,32,32
     ,593
22   680 DATA 32,35,35,35,35,35,2
     9,60,32,32,32,29,91,32,29,58
     ,631
25   690 DATA 32,32,32,32,32,29,5
     8,32,32,32,29,58,32,32,32,29
     ,555
8A   700 DATA 32,32,29,60,32,32,3
     2,32,62,29,43,32,32,59,29,60
     ,627
29   710 DATA 32,32,32,29,92,32,2
     9,60,32,32,22,32,32,29,60,32
     ,619
E1   720 DATA 32,32,29,60,32,32,3
     2,29,32,32,36,58,32,32,32,32
     ,584
5C   730 DATA 59,29,58,32,32,32,2
     9,58,32,32,32,29,93,32,32,32
     ,643
3C   740 DATA 32,32,32,32,32,29,5
     0,32,32,62,29,60,32,32,32,29
     ,589
9E   750 DATA 32,32,32,32,32,32,3
     2,32,32,36,58,32,32,32,36,58
     ,572
9D   760 DATA 32,32,32,29,94,32,3
     2,32,32,32,32,32,32,32,32,32
     ,571
76   770 DATA 32,32,32,32,32,32,3
     2,29,32,32,32,32,32,32,32,32
     ,509
DD   780 DATA 32,32,32,32,32,32,3
     2,32,32,32,59,29,95,32,32,32
     ,599
73   790 DATA 32,32,32,32,32,32,3
     2,32,32,32,29,60,32,32,32,29
     ,533
32   800 DATA 96,32,32,32,32,32,3
     2,32,32,32,32,32,32,62,29,58
     ,629
55   810 DATA 32,32,32,29,97,32,3
     2,32,32,32,32,32,32,32,32,32
     ,574
3C   820 DATA 32,32,29,60,32,32,3
     2,29,98,32,29,60,32,32,89,32
     ,680
E0   830 DATA 32,32,32,32,32,59,3
     6,58,32,32,62,29,32,32,29,60
     ,621
BC   840 DATA 32,32,89,32,32,29,6
     0,32,32,32,32,32,32,32,32,29
     ,590
5E   850 DATA 32,62,29,58,32,32,3
     2,32,32,29,60,32,32,32,32,32
     ,590
0C   860 DATA 32,32,32,29,32,32,2
     9,60,32,32,22,32,59,29,60,32
     ,595
5E   870 DATA 32,32,32,32,32,32,3
     2,29,32,32,29,58,32,32,32,32
     ,532
1E   880 DATA 32,29,60,32,32,32,3
     2,32,32,32,59,29,32,32,29,60
     ,585
EF   890 DATA 32,32,32,32,62,29,6
     0,32,32,32,32,32,32,32,32,29
     ,564
80   900 DATA 32,32,29,58,32,32,3
     2,32,32,34,34,34,34,34,34,34
     ,549
A8   910 DATA 34,34,34,29,32,32,2
     9,60,32,32,32,32,32,35,35,35
     ,549
8A   920 DATA 35,35,35,35,35,35,3
     5,29,32,32,29,58,32,32,22,32
     ,553
84   930 DATA 32,29,43,32,32,32,3
     2,32,32,32,32,29,32,32,29,60
     ,542
12   940 DATA 32,32,32,32,59,29,7
     8,32,32,32,32,32,32,32,32,29
     ,579
8C   950 DATA 32,59,29,60,32,32,3
     2,32,32,29,42,32,32,32,32,32
     ,571
99   960 DATA 32,32,32,29,32,32,2
     9,58,32,32,32,32,32,29,43,32
     ,540
77   970 DATA 32,62,29,60,32,32,3
     2,29,32,32,29,60,32,32,32,32
     ,588
F1   980 DATA 32,29,78,32,32,32,2
     9,58,32,32,32,29,32,32,34,34
     ,579
27   990 DATA 34,34,34,34,34,29,4
     3,32,32,59,29,60,32,32,32,29
     ,579
CC   1000 DATA 32,32,35,35,35,35,
     35,35,35,29,42,32,32,32,29,5
     8,563
54   1010 DATA 32,32,32,29,32,32,
     29,60,32,32,32,32,32,29,78,3
     2,577
42   1020 DATA 32,32,29,60,32,32,
     32,29,32,32,29,58,32,32,32,3
     2,557
CD   1030 DATA 62,29,43,32,32,32,
     29,60,32,32,32,29,32,32,29,6
     0,597
5E   1040 DATA 32,32,32,32,32,29,
     43,32,32,32,29,58,32,32,32,2
     9,540
3C   1050 DATA 32,32,29,60,32,32,
     32,32,32,29,78,32,32,32,29,6
     0,605
DD   1060 DATA 32,32,32,29,32,32,
     29,58,32,32,32,32,32,34,34,3
     4,538
31   1070 DATA 34,34,29,60,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,563
FA   1080 DATA 32,35,35,35,35,35,
     29,58,32,32,32,29,32,32,29,5
     8,570
DD   1090 DATA 32,32,32,32,59,29,
     78,32,32,32,29,60,32,32,32,2
     9,604
9D   1100 DATA 32,32,29,60,32,32,
     32,32,32,29,42,32,32,62,29,5
     8,597
23   1110 DATA 32,32,32,29,32,32,
     29,60,32,32,32,32,62,29,43,3
     2,572
74   1120 DATA 32,32,36,58,32,32,
     32,29,32,32,29,58,32,32,32,3
     2,562
68   1130 DATA 32,29,78,32,32,32,
     32,32,32,32,32,29,32,32,29,6
     0,577
4C   1140 DATA 32,32,32,32,32,29,
     43,32,32,32,32,32,32,32,62,2
     9,547
DA   1150 DATA 32,32,29,60,32,32,
     32,32,59,29,60,32,32,32,32,3
     2,589
F3   1160 DATA 32,32,32,29,32,32,
     29,60,32,32,32,32,32,29,58,3
     2,557
FB   1170 DATA 32,32,32,32,32,32,
     32,29,32,62,29,58,32,32,32,3
     2,562
2F   1180 DATA 32,29,60,32,32,32,
     32,32,32,32,59,29,32,32,29,6
     0,586
B5   1190 DATA 32,32,32,32,32,29,
     58,32,32,32,88,32,32,32,32,2
     9,588
CA   1200 DATA 32,32,29,60,32,32,
     32,32,62,36,58,32,32,32,89,3
     2,654
4A   1210 DATA 32,32,32,29,32,59,
     29,70,60,32,32,32,32,32,32,3
     2,599
0F   1220 DATA 32,32,32,32,32,32,
     32,29,32,32,29,70,71,60,32,3
     2,611
39   1230 DATA 32,32,32,32,32,29,
     60,32,32,32,59,29,32,32,29,7
     0,595
FB   1240 DATA 71,71,60,32,32,32,
     32,32,59,29,60,32,32,32,32,2
     9,667
40   1250 DATA 32,32,29,70,72,71,
     72,60,32,32,32,32,32,29,58,3
     2,717
2D   1260 DATA 32,32,62,29,32,32,
     29,70,71,72,71,71,60,32,32,3
     2,759
34   1270 DATA 62,29,60,32,32,32,
     32,29,32,32,29,70,71,72,71,7
     1,756
1E   1280 DATA 60,32,32,32,32,29,
     58,32,32,32,32,29,32,32,29,6
     0,595
0C   1290 DATA 107,71,71,60,32,32
     ,32,32,32,29,60,32,32,32,32,
     29,715
```

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82   1300 DATA 32,32,29,70,60,107
     ,71,60,32,32,32,32,59,29,60,
     32,769
34   1310 DATA 32,32,32,29,32,32,
     29,70,60,107,72,71,60,32,32,
     32,754
A8   1320 DATA 32,29,58,32,32,32,
     32,29,32,62,29,70,71,60,107,
     71,778
C8   1330 DATA 60,32,32,32,32,29,
     60,32,32,32,32,29,32,32,29,1
     07,634
04   1340 DATA 68,58,107,68,58,32
     ,32,32,32,29,58,32,32,32,59,
     29,758
42   1350 DATA 32,59,29,58,32,32,
     32,32,32,32,32,32,32,29,60,3
     2,587
27   1360 DATA 32,32,32,29,32,32,
     29,32,32,32,32,32,32,32,32,3
     2,506
45   1370 DATA 32,29,58,32,32,32,
     32,29,32,32,34,34,34,34,34,3
     4,544
81   1380 DATA 34,34,34,34,34,29,
     60,32,32,32,32,29,32,32,35,3
     5,550
70   1390 DATA 35,35,35,35,35,35,
     35,35,35,29,58,32,32,32,32,2
     9,559
F7   1400 DATA 32,32,29,32,32,32,
     32,32,32,32,32,32,32,29,60,3
     2,534
8A   1410 DATA 32,32,32,29,32,32,
     29,60,32,88,32,32,32,32,32,3
     2,590
B2   1420 DATA 32,29,60,32,32,32,
     59,29,32,32,29,60,32,89,32,3
     2,643
49   1430 DATA 32,32,32,32,32,34,
     34,34,34,34,34,29,32,62,29,7
     0,586
30   1440 DATA 60,32,107,60,32,32
     ,32,32,32,35,35,35,35,35,35,
     29,658
E1   1450 DATA 32,32,29,70,70,60,
     107,71,60,32,32,32,59,29,60,
     32,807
C4   1460 DATA 32,32,32,29,32,32,
     29,70,71,71,71,71,60,32,32,3
     2,729
0C   1470 DATA 32,29,58,32,32,32,
     32,29,32,32,29,70,60,71,71,7
     1,712
53   1480 DATA 60,32,32,32,62,29,
     60,32,32,32,32,29,32,59,29,7
     0,654
C3   1490 DATA 60,79,71,71,71,60,
     32,32,32,35,58,32,32,32,32,2
     9,759
95   1500 DATA 32,32,29,70,60,32,
     107,71,58,32,32,32,32,32,32,
     32,715
08   1510 DATA 32,32,62,29,32,32,
     29,70,60,32,32,58,32,32,32,3
     2,628
64   1520 DATA 32,32,32,32,32,32,
     32,29,32,32,29,70,71,60,32,3
     2,611
9D   1530 DATA 32,32,32,32,32,32,
     32,32,32,32,32,29,32,32,29,7
     0,544
FD   1540 DATA 68,58,32,32,32,32,
     32,32,32,32,32,32,32,32,59,2
     9,599
61   1550 DATA 32,32,29,68,58,32,
     32,32,32,32,32,32,32,32,32,3
     2,571
90   1560 DATA 32,32,32,29,32,62,
     29,60,32,32,32,32,32,32,32,3
     2,564
9D   1570 DATA 32,32,32,32,32,32,
     32,29,91,32,29,58,32,32,32,3
     2,591
88   1580 DATA 32,32,32,32,32,32,
     32,32,32,32,62,29,32,32,35,5
     8,569
C8   1590 DATA 32,32,32,32,32,32,
     32,32,28,60,32,32,32,32,32,2
     9,533
1D   1600 DATA 92,32,32,32,32,32,
     32,32,32,32,32,62,29,58,32,3
     2,625
BC   1610 DATA 88,32,32,29,32,32,
     32,32,32,32,32,32,32,32,32,3
     2,565
5A   1620 DATA 29,60,32,32,89,32,
     32,29,93,32,32,32,32,32,32,3
     2,652
DE   1630 DATA 32,32,32,32,29,60,
     32,32,32,32,32,29,32,32,32,3
     2,534
C8   1640 DATA 32,32,32,32,32,32,
     32,32,29,58,32,32,32,32,32,2
     9,532
E5   1650 DATA 94,32,32,32,32,32,
     32,32,32,32,32,32,29,60,32,3
     2,599
FC   1660 DATA 32,32,32,29,32,32,
     32,32,32,32,32,32,32,32,32,5
     9,536
4F   1670 DATA 29,58,32,32,32,32,
     32,29,95,32,32,32,32,32,32,3
     2,595
C0   1680 DATA 32,32,32,32,29,60,
     32,32,32,32,59,29,96,32,32,3
     2,625
EC   1690 DATA 32,32,32,32,32,32,
     32,32,29,58,32,32,32,32,32,2
     9,532
8B   1700 DATA 97,32,29,60,32,32,
     32,32,32,32,32,62,29,60,32,3
     2,656
7E   1710 DATA 32,32,32,29,98,59,
     29,60,32,32,32,32,32,32,32,3
     2,627
22   1720 DATA 29,60,32,32,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,559
F0   1730 DATA 32,32,32,32,29,58,
     32,32,32,32,32,29,32,32,29,5
     8,555
30   1740 DATA 32,32,32,32,32,32,
     32,62,29,60,32,32,32,32,32,2
     9,564
EC   1750 DATA 32,32,29,60,32,32,
     32,32,32,32,32,32,35,58,32,3
     2,567
C8   1760 DATA 32,32,32,29,32,62,
     29,60,32,32,32,32,32,32,32,3
     2,564
19   1770 DATA 32,32,32,32,32,32,
     32,29,32,32,29,58,32,32,32,3
     2,532
E1   1780 DATA 32,32,32,32,32,32,
     32,32,32,32,62,29,32,32,29,5
     8,562
C5   1790 DATA 32,32,32,32,32,88,
     32,32,32,32,32,32,32,32,32,2
     9,565
9A   1800 DATA 32,32,29,60,32,32,
     32,32,32,89,32,32,32,32,28,6
     0,518
06   1810 DATA 32,32,32,29,32,32,
     29,58,32,32,32,32,32,32,32,3
     2,532
F9   1820 DATA 32,32,29,60,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,559
68   1830 DATA 29,60,32,32,32,59,
     29,58,32,32,32,29,32,32,28,6
     0,509
87   1840 DATA 32,32,32,62,29,60,
     32,32,32,32,29,60,32,32,32,2
     9,589
C8   1850 DATA 32,32,29,58,32,32,
     32,32,29,60,32,32,32,62,29,5
     8,613
89   1860 DATA 32,32,32,29,32,32,
     29,60,32,32,32,32,29,70,60,3
     2,597
8E   1870 DATA 32,32,29,60,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,559
47   1880 DATA 29,70,60,32,32,32,
     35,58,32,32,32,29,32,32,34,3
     4,606
45   1890 DATA 34,34,34,34,29,70,
     60,32,32,32,32,32,32,32,59,2
     9,607
45   1900 DATA 32,32,35,35,35,35,
     35,35,29,70,70,60,32,32,32,3
     2,631
6E   1910 DATA 32,32,32,29,32,32,
     29,60,32,32,32,32,29,70,71,6
     0,636
E1   1920 DATA 32,32,32,32,32,32,
     32,29,32,62,29,60,32,32,32,3
     2,564
A3   1930 DATA 29,70,71,71,60,32,
     32,32,32,32,32,29,32,32,29,5
     8,573
98   1940 DATA 32,32,32,32,29,70,
     71,72,58,32,32,32,32,32,32,2
     9,549
93   1950 DATA 32,32,29,60,32,32,
     32,59,29,71,71,73,60,32,32,3
     2,708
C9   1960 DATA 32,32,32,29,32,59,
     29,58,32,32,32,62,29,70,70,7
     0,700
89   1970 DATA 60,32,32,32,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,552
6A   1980 DATA 36,35,36,35,58,32,
     32,32,32,32,32,29,32,32,29,5
     9,574
21   1990 DATA 32,32,32,32,32,32,
     32,32,32,32,88,32,32,32,32,2
     9,565
81   2000 DATA 32,32,29,60,32,32,
     32,32,32,32,32,32,32,32,89,3
     2,594
5A   2010 DATA 32,32,32,29,32,32,
     29,58,32,32,32,32,32,32,32,2
     9,529
93   2020 DATA 60,32,32,32,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,552
2C   2030 DATA 32,32,32,29,60,32,
     32,32,32,32,32,29,32,32,29,5
     8,557
8E   2040 DATA 32,32,32,32,32,32,
     32,34,34,34,34,34,34,34,34,2
     9,525
5C   2050 DATA 32,32,29,58,32,32,
     32,32,32,32,32,35,35,35,35,3
     5,550
FC   2060 DATA 35,35,35,29,32,32,
     29,60,32,32,32,32,32,32,59,2
     9,567
6B   2070 DATA 60,32,32,32,32,32,
     32,29,32,32,29,60,32,32,32,3
     2,552
2E   2080 DATA 32,32,32,29,58,32,
     32,32,32,32,32,29,32,32,29,5
     8,555
AC   2090 DATA 32,32,32,32,32,32,
     62,35,58,32,32,32,32,32,32,2
     9,558
93   2100 DATA 32,32,29,60,32,32,
     32,32,32,32,32,32,32,32,32,3
     2,537
E1   2110 DATA 32,32,32,29,32,59,
     29,60,32,32,32,32,32,32,32,3
     2,561
```

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61  2120 DATA 32,32,32,32,32,32,
    59,29,32,32,29,58,32,32,32,3
    2,559
3C  2130 DATA 32,32,32,88,32,32,
    28,60,32,32,32,29,32,32,29,6
    0,614
87  2140 DATA 32,32,32,32,32,32,
    32,89,32,32,29,60,32,32,32,2
    9,591
57  2150 DATA 32,32,29,60,32,32,
    32,32,32,32,32,32,32,29,5
    8,560
79  2160 DATA 32,32,32,29,32,62,
    29,58,32,32,32,32,32,32,32,3
    2,552
4A  2170 DATA 32,59,29,50,32,32,
    32,29,32,32,29,58,32,32,32,3
    2,584
F8  2180 DATA 32,32,32,32,32,32,
    29,60,32,32,32,29,32,32,34,3
    4,538
31  2190 DATA 34,34,34,34,34,34,
    34,34,34,34,29,58,32,32,32,2
    9,552
14  2200 DATA 91,32,35,35,35,35,
    35,35,35,35,35,35,35,35,29,6
    0,532
70  2210 DATA 32,32,32,29,32,32,
    29,60,32,32,32,32,32,32,32,3
    2,534
03  2220 DATA 32,32,29,60,32,32,
    62,29,92,32,29,60,32,32,32,3
    2,649
01  2230 DATA 32,32,32,32,32,59,
    29,58,32,32,32,29,32,32,29,5
    8,582
3C  2240 DATA 32,32,32,32,32,32,
    32,32,32,32,29,60,32,32,32,2
    9,534
25  2250 DATA 93,32,29,60,32,32,
    32,32,32,88,32,32,32,32,29,5
    8,577
DF  2260 DATA 32,32,32,29,32,32,
    29,60,32,32,32,32,32,89,32,3
    2,591
2A  2270 DATA 32,32,29,60,32,32,
    32,29,94,32,29,58,32,32,32,3
    2,519
7E  2280 DATA 32,32,32,32,32,62,
    29,60,32,32,32,29,32,32,29,6
    0,589
0D  2290 DATA 32,32,32,32,29,60,
    32,32,32,32,29,58,32,32,32,2
    9,556
07  2300 DATA 95,32,29,60,32,32,
    32,59,29,58,32,32,32,32,29,6
    0,675
F2  2310 DATA 32,32,59,29,96,32,
    29,60,32,32,32,32,29,60,32,3
    2,550
96  2320 DATA 32,32,29,50,32,32,
    32,29,97,32,29,58,32,32,32,6
    2,652
2E  2330 DATA 29,60,32,32,32,32,
    29,58,32,32,32,29,98,32,29,6
    0,648
08  2340 DATA 32,32,32,32,29,58,
    32,32,32,62,29,60,32,32,32,2
    9,587
CC  2350 DATA 32,32,29,60,32,32,
    32,32,29,60,32,32,32,32,29,5
    8,585
05  2360 DATA 32,32,32,29,32,59,
    29,58,32,32,32,32,34,34,34,3
    4,567
16  2370 DATA 34,34,29,60,32,32,
    32,29,32,32,29,60,32,32,32,3
    2,563
9F  2380 DATA 35,35,35,35,35,35,
    29,60,32,32,32,29,32,32,29,6
    0,577
47  2390 DATA 32,32,32,59,29,60,
    32,32,32,32,29,58,32,32,32,2
    9,584
9D  2400 DATA 32,62,29,58,32,32,
    32,32,29,60,32,32,32,32,29,6
    0,615
C4  2410 DATA 32,32,32,29,32,32,
    29,60,32,32,32,62,35,58,32,3
    2,594
16  2420 DATA 32,32,36,58,32,32,
    32,29,32,32,29,60,32,32,32,3
    2,564
DC  2430 DATA 32,32,32,32,32,32,
    32,32,32,32,32,29,32,32,29,5
    8,532
BA  2440 DATA 32,32,32,32,32,32,
    32,32,32,32,32,32,32,32,32,2
    9,509
92  2450 DATA 32,32,29,60,32,32,
    32,32,32,32,32,32,32,32,32,3
    2,537
33  2460 DATA 32,32,32,29,32,32,
    29,60,32,32,32,32,32,32,32,3
    2,534
27  2470 DATA 32,32,32,32,32,32,
    32,29,32,32,29,70,60,32,32,3
    2,572
CF  2480 DATA 32,32,88,32,32,32,
    32,32,32,32,32,29,32,32,29,7
    0,600
82  2490 DATA 58,32,32,32,32,32,
    89,32,62,28,59,32,32,32,32,2
    9,644
A4  2500 DATA 32,59,29,70,60,32,
    32,32,32,32,32,32,28,29,58,3
    2,621
44  2510 DATA 32,32,32,29,32,32,
    29,70,58,32,32,32,32,32,32,2
    9,566
89  2520 DATA 29,29,60,32,32,32,
    32,29,32,32,36,36,58,32,32,3
    2,565
39  2530 DATA 32,32,28,29,29,29,
    60,32,32,32,62,29,32,32,32,3
    2,554
2A  2540 DATA 32,32,32,32,32,62,
    29,29,29,29,58,32,32,32,32,2
    9,553
3A  2550 DATA 32,32,32,32,32,32,
    32,32,32,32,87,29,29,29,60,3
    2,586
49  2560 DATA 32,32,59,29,32,32,
    28,70,60,32,32,32,32,32,32,2
    9,595
1A  2570 DATA 29,29,58,32,32,32,
    32,29,32,32,29,70,60,32,32,3
    2,592
2E  2580 DATA 32,32,62,29,29,29,
    60,32,32,32,32,29,32,32,29,7
    0,593
2E  2590 DATA 70,60,32,32,32,32,
    32,29,29,29,58,32,32,32,32,2
    9,592
AA  2600 DATA 32,59,29,70,70,58,
    32,32,32,32,59,29,29,29,60,3
    2,684
51  2610 DATA 32,32,32,29,32,32,
    29,70,70,60,32,32,32,32,32,2
    9,607
74  2620 DATA 29,29,50,32,32,32,
    32,29,32,32,36,36,36,58,32,3
    2,569
C9  2630 DATA 32,32,32,87,29,29,
    60,32,32,32,32,29,32,32,32,3
    2,585
D6  2640 DATA 32,32,32,32,32,32,
    32,32,29,29,58,32,88,32,32,2
    9,585
6E  2650 DATA 32,32,32,32,32,32,
    32,32,32,32,32,55,29,29,60,3
    2,561
09  2660 DATA 89,32,32,29,32,32,
    28,37,60,32,32,32,32,32,32,3
    2,595
FC  2670 DATA 29,29,58,32,32,32,
    32,29,32,32,29,37,60,32,32,3
    2,559
06  2680 DATA 32,32,32,62,29,29,
    60,32,32,32,32,29,32,62,29,3
    7,593
60  2690 DATA 37,60,32,32,32,32,
    32,32,29,29,60,32,32,32,59,2
    9,591
14  2700 DATA 32,32,29,37,37,37,
    60,32,32,32,32,32,87,29,58,3
    2,630
F6  2710 DATA 32,32,32,29,32,59,
    29,37,37,46,60,32,32,32,32,3
    2,585
05  2720 DATA 32,29,60,32,32,32,
    62,29,32,32,29,37,46,46,37,6
    0,627
EA  2730 DATA 32,32,32,32,32,29,
    58,32,32,32,32,29,32,32,29,4
    6,543
DD  2740 DATA 46,46,46,37,60,32,
    32,32,59,29,60,32,32,32,32,2
    9,636
F5  2750 DATA 32,32,29,46,46,37,
    37,58,32,32,32,32,32,29,58,3
    2,596
2D  2760 DATA 32,32,32,29,32,32,
    29,46,46,37,60,32,32,32,32,3
    2,567
CA  2770 DATA 62,29,32,32,32,32,
    32,29,32,32,29,37,37,58,32,3
    2,569
75  2780 DATA 32,32,32,32,32,29,
    60,32,32,32,32,29,32,32,29,3
    7,536
13  2790 DATA 58,32,32,32,32,32,
    32,32,32,36,58,32,32,32,32,2
    9,565
2D  2800 DATA 32,32,29,37,60,32,
    32,32,32,32,32,32,32,32,32,3
    2,542
67  2810 DATA 32,32,32,29,32,32,
    29,37,58,32,32,32,32,32,32,3
    2,537
06  2820 DATA 32,32,32,32,32,32,
    32,29,32,32,90,37,78,32,32,3
    2,518
F8  2830 DATA 32,32,32,32,32,32,
    32,32,32,32,32,67,32,32,90,3
    7,610
9C  2840 DATA 60,32,32,32,32,32,
    32,32,32,32,32,32,32,32,32,6
    7,575
01  2850 DATA 32,32,90,37,60,32,
    32,32,32,32,32,32,32,32,32,3
    2,503
CC  2860 DATA 32,32,32,67,32,32,
    90,37,37,60,32,32,32,32,32,3
    2,643
BF  2870 DATA 32,32,32,32,32,32,
    32,67,91,32,90,37,37,37,60,3
    2,707
DF  2880 DATA 32,32,32,32,32,32,
    32,32,32,32,32,67,32,32,90,8
    3,656
DA  2890 DATA 40,84,37,60,32,32,
    32,32,32,32,32,32,32,32,32,6
    7,640
9D  2900 DATA 92,32,90,47,47,47,
    37,60,32,32,32,32,32,32,32,3
    2,708
E9  2910 DATA 32,32,32,67,32,32,
    90,37,83,40,84,37,60,32,32,3
    2,754
0F  2920 DATA 32,32,32,32,32,32,
    32,67,93,32,90,37,47,47,47,3
    7,721
10  2930 DATA 60,107,60,32,32,32
    ,32,32,32,32,32,67,32,32,90,
    37,741
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80  2940 DATA 37,83,40,84,37,37,
    37,60,32,32,32,32,32,32,32,6
    7,706
4A  2950 DATA 94,32,90,37,37,47,
    47,47,46,45,46,37,60,32,32,3
    2,762
E1  2960 DATA 32,32,86,37,32,32,
    90,37,37,83,40,84,46,46,47,3
    7,798
72  2970 DATA 58,32,32,32,32,86,
    37,37,95,32,90,37,37,47,47,4
    7,778
84  2980 DATA 46,37,37,58,32,32,
    32,32,85,37,37,37,96,32,90,3
    7,758
84  2990 DATA 83,40,84,37,37,58,
    32,32,32,32,32,86,37,37,37,3
    7,733
40  3000 DATA 97,32,90,37,47,47,
    47,37,60,32,32,32,32,32,86,8
    1,821
EC  3010 DATA 80,80,45,45,99,32,
    90,83,40,84,37,58,32,32,32,3
    2,900
11  3020 DATA 32,32,82,81,46,40,
    40,46,32,32,90,47,47,47,60,3
    2,786
D5  3030 DATA 32,32,32,32,32,32,
    82,81,46,39,39,46,32,32,90,3
    7,716
22  3040 DATA 37,58,32,32,32,32,
    32,32,32,32,82,37,47,47,47,4
    7,658
5E  3050 DATA 0,0,0,73,0,139,109
    ,0,0,48,72,20,34,62,34,65,65
    6
32  3060 DATA 0,92,34,66,124,66,
    34,92,0,28,34,84,80,80,34,28
    ,876
37  3070 DATA 0,88,100,66,66,66,
    100,88,0,92,34,64,112,64,34,
    92,1066
01  3080 DATA 0,92,34,32,120,32,
    32,64,0,28,34,64,94,98,62,2,
    788
85  3090 DATA 6,28,34,32,60,34,3
    4,36,0,2,60,72,8,10,60,64,54
    0
5E  3100 DATA 0,1,2,2,2,34,68,58
    ,0,66,36,40,112,40,36,66,561

45  3110 DATA 0,24,36,32,32,32,3
    3,94,0,84,42,42,106,42,42,64
    ,705
B4  3120 DATA 0,66,50,42,106,42,
    42,68,0,28,34,81,81,81,34,28
    ,783
C5  3130 DATA 0,92,34,34,124,32,
    32,64,0,56,84,34,2,12,26,124
    ,750
3A  3140 DATA 0,92,34,34,120,36,
    34,66,0,2,60,64,60,2,60,64,7
    28
4E  3150 DATA 0,1,125,48,90,90,3
    3,30,0,33,82,18,18,18,18,12,
    597
25  3160 DATA 0,76,178,34,34,34,
    20,8,0,128,92,82,82,82,84,40
    ,974
ED  3170 DATA 0,34,84,12,8,24,37
    ,66,0,66,154,36,36,26,66,60,
    719
54  3180 DATA 0,126,2,4,8,16,32,
    126,126,181,149,170,89,89,89
    ,238,1445
3E  3190 DATA 5,21,85,102,153,11
    8,153,103,85,85,85,102,153,1
    10,149,101,1610
D2  3200 DATA 85,87,95,175,191,1
    75,191,175,5,21,85,238,153,1
    53,153,238,2220
C4  3210 DATA 0,0,0,0,0,0,0,0,17
    5,191,239,191,172,188,224,12
    8,1508
80  3220 DATA 176,176,175,149,15
    4,175,176,176,14,14,14,86,16
    6,14,14,14,1695
25  3230 DATA 85,87,93,183,157,1
    82,155,172,149,149,149,238,8
    9,89,89,238,2304
20  3240 DATA 85,85,89,174,89,89
    ,89,174,21,17,21,17,21,17,21
    ,17,1027
99  3250 DATA 34,34,34,34,238,34
    ,34,34,84,92,100,220,180,156
    ,164,212,1684
84  3260 DATA 85,149,80,32,0,0,0
    ,0,85,89,89,0,0,0,0,0,589
AC  3270 DATA 148,152,164,92,180
    ,152,172,148,21,17,21,17,21,
    17,21,17,1360
2C  3280 DATA 17,85,17,85,17,85,
    17,85,21,21,21,46,25,25,25,4
    6,638
BB  3290 DATA 28,34,65,73,65,34,
    28,0,28,8,8,24,16,16,56,0,48
    3
D6  3300 DATA 60,70,4,24,32,66,1
    26,0,60,66,2,12,2,66,60,0,65
    0
D6  3310 DATA 14,20,36,126,4,4,1
    4,0,126,66,64,124,2,66,60,0,
    726
AD  3320 DATA 60,66,64,124,66,66
    ,60,0,126,66,4,30,8,16,56,0,
    812
7C  3330 DATA 60,66,66,60,66,66,
    60,0,60,66,66,62,4,8,48,0,75
    8
40  3340 DATA 117,85,84,20,24,16
    ,32,0,0,0,32,16,16,148,70,65
    ,726
85  3350 DATA 85,148,84,81,17,33
    ,2,0,0,1,37,1,1,9,1,0,501
2E  3360 DATA 16,4,60,239,175,23
    9,255,60,0,0,0,0,0,0,0,0,104
    8
A2  3370 DATA 48,32,132,132,132,
    132,184,32,16,128,160,96,16,
    128,160,96,1624
4A  3380 DATA 21,149,149,238,153
    ,153,153,46,168,221,17,17,85
    ,0,85,85,1740
FC  3390 DATA 162,153,105,123,23
    4,185,111,124,38,234,185,206
    ,170,234,158,234,2658
42  3400 DATA 90,233,165,234,165
    ,235,174,106,230,170,170,170
    ,238,171,234,110,2817
D1  3410 DATA 170,186,174,174,15
    8,174,186,169,171,170,154,17
    0,170,42,169,158,2605
9F  3420 DATA 169,169,170,170,18
    6,174,186,170,154,221,17,17,
    85,0,85,85,2058
87  3430 DATA 134,124,134,0,0,85
    ,85,0,85,89,89,92,88,92,152,
    48,1297
19  3440 DATA 85,85,21,5,1,0,0,0
    ,64,80,86,80,80,88,80,64,819

3D  3450 DATA 21,17,21,17,21,17,
    21,17,149,149,149,234,85,85,
    0,0,1003
E4  3460 DATA 85,85,85,174,89,89
    ,89,174,81,72,98,0,34,0,34,0
    ,1189
6B  3470 DATA 0,34,0,34,0,42,0,0
    ,5,22,89,174,89,89,89,174,84
    1
47  3480 DATA 1,5,21,239,153,153
    ,153,174,85,87,93,183,157,18
    3,157,181,2024
EE  3490 DATA 0,32,148,32,0,32,1
    49,32,0,10,85,10,5,10,85,10,
    641
32  3500 DATA 169,221,17,17,85,0
    ,85,85,0,0,0,0,0,0,0,0,578
10  3510 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
1E  3520 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
04  3530 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
C5  3540 DATA 0,0,0,0,0,0,0,0,25
    3,113,48,60,60,48,113,253,94
    8
29  3550 DATA 51,51,29,4,4,29,51
    ,51,31,4,12,12,12,12,4,31,38
    8
0E  3560 DATA 63,21,12,12,12,12,
    12,13,0,168,42,213,85,42,168
    ,0,875
2E  3570 DATA 0,0,0,255,85,0,0,0
    ,0,0,0,255,85,0,0,0,680
8D  3580 DATA 0,32,8,254,94,9,32
    ,0,0,0,8,4,4,37,145,80,708
FE  3590 DATA 85,255,0,0,0,0,0,0
    ,5,15,0,0,0,0,0,0,360
4D  3600 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
BE  3610 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
A1  3620 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
AF  3630 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
4D  3640 DATA 0,0,0,0,0,0,0,0,0,
    255,0,255,0,255,0,254,1019
F5  3650 DATA 0,255,0,255,0,255,
    0,255,0,255,0,255,0,255,0,25
    5,2040
FF  3660 DATA 0,255,0,255,0,255,
    0,255,0,255,0,255,0,255,0,25
    5,2040
C1  3670 DATA 0,255,0,255,0,255,
    0,255,0,255,0,255,0,255,0,25
    5,2040
93  3680 DATA 0,255,0,255,0,255,
    0,255,0,255,0,255,0,255,253,
    16,2054
DA  3690 DATA 32,152,144,32,35,1
    35,32,21,161,162,0,142,33,20
    8,142,95,1537
D9  3700 DATA 3,142,97,3,142,100
    ,3,142,4,212,142,101,3,142,1
    03,3,1342
BA  3710 DATA 232,142,98,3,232,1
    42,102,3,165,240,141,1,212,1
    69,20,141,2047
D4  3720 DATA 99,3,169,128,141,4
    ,212,160,8,140,104,3,169,10,
    141,5,1497
C3  3730 DATA 212,141,6,212,169,
    120,133,251,169,4,133,252,17
    3,22,208,41,2246
79  3740 DATA 247,141,22,208,32,
    39,37,173,98,3,240,251,32,16
    2,144,96,1923
B4  3750 DATA 173,25,208,141,25,
    208,41,1,208,3,76,49,234,173
    ,17,208,1790
22  3760 DATA 41,127,141,17,208,
    152,7,189,0,34,168,202,189,0
    ,34,157,1676
19  3770 DATA 1,34,224,0,208,245
    ,152,157,0,34,173,100,3,208,
    50,56,1645
7D  3780 DATA 173,1,212,233,10,1
    41,1,212,169,128,141,4,212,2
    4,165,251,2077
92  3790 DATA 105,40,133,251,165
    ,252,105,0,133,252,169,64,16
    0,39,169,64,2101
1D  3800 DATA 145,251,73,96,136,
    16,249,206,99,3,16,174,140,1
```

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     00,3,208,1915
C1   3810 DATA 169,173,101,3,208,
     19,160,11,169,32,153,23,6,15
     3,83,6,1449
59   3820 DATA 153,103,6,136,16,2
     44,140,101,3,206,102,3,208,5
     5,169,2,1647
0E   3830 DATA 141,102,3,172,104,
     3,16,5,160,8,140,104,3,185,7
     8,37,1261
65   3840 DATA 153,64,6,141,1,212
     ,24,173,103,3,105,1,41,7,208
     ,2,1244
53   3850 DATA 105,1,153,64,218,1
     41,103,3,169,0,141,4,212,169
     ,17,141,1641
6C   3860 DATA 4,212,206,104,3,20
     6,97,3,209,10,206,99,3,208,5
     ,169,1742
C8   3870 DATA 1,141,96,3,76,49,2
     34,120,169,48,141,18,208,169
     ,95,141,1710
E2   3880 DATA 20,3,169,36,141,21
     ,3,173,17,208,41,127,141,17,
     208,169,1494
E3   3890 DATA 1,141,26,208,173,1
     4,220,41,254,141,14,220,88,9
     6,7,1,1645
9E   3900 DATA 13,5,32,15,22,5,18
     ,255,169,29,141,21,208,169,1
     77,141,1420
69   3910 DATA 250,7,162,199,142,
     249,7,232,142,248,7,169,4,14
     1,16,208,2183
65   3920 DATA 169,31,141,28,208,
     169,216,141,22,208,162,2,142
     ,105,3,232,1979
46   3930 DATA 142,237,2,142,41,2
     08,169,0,141,0,208,141,236,2
     ,141,104,1914
07   3940 DATA 3,169,85,141,1,208
     ,169,6,141,4,208,169,109,141
     ,5,208,1767
DE   3950 DATA 160,120,169,32,153
     ,160,4,136,16,250,160,160,18
     5,217,37,153,2112
C7   3960 DATA 23,5,136,208,247,1
     60,240,169,37,153,183,5,169,
     32,153,167,2087
0C   3970 DATA 6,153,247,6,136,20
     8,240,160,39,169,105,153,168
     ,6,136,16,1948
61   3980 DATA 250,169,62,141,55,
     5,96,218,37,0,0,0,0,0,0,0,10
     33
D9   3990 DATA 169,0,133,250,169,
     133,133,251,169,64,133,174,1
     33,193,169,13,2296
89   4000 DATA 133,175,133,194,16
     9,160,133,252,169,157,133,25
     3,160,0,177,250,2648
74   4010 DATA 145,174,230,250,20
     8,2,230,251,230,174,208,2,23
     0,175,165,250,2924
36   4020 DATA 197,252,208,234,16
     5,251,197,253,208,228,169,59
     ,133,187,169,158,3068
48   4030 DATA 133,188,169,3,133,
     183,169,0,133,185,160,0,185,
     11,158,240,2050
2F   4040 DATA 6,32,210,255,200,2
     08,245,32,207,255,240,251,20
     1,49,240,4,2635
F8   4050 DATA 201,56,48,230,41,1
     5,133,186,76,234,245,147,17,
     17,73,78,1797
27   4060 DATA 80,85,84,32,68,69,
     86,73,67,69,32,78,85,77,66,6
     9,1120
75   4070 DATA 82,13,17,67,65,83,
     61,49,32,47,32,68,73,83,75,6
     1,908
D1   4080 DATA 32,56,32,79,82,32,
     57,58,45,32,0,87,84,49,0,0,7
     25
99   4090 DATA 0,0,0,0,0,0,0,0,0,
     0,0,255,255,255,255,0,1020
```

PROGRAM: WT2.BAS

```
D9   10 BL=429  :LN=50   :SA=3404
     8
F9   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15
88   21 READ A:POKE53280,A
9E   22 CX=CX+A:POKE SA+L*16+D,A:
     NEXT
A2   30 READA:IF A=CX THEN40
12   31 PRINT"ERROR IN LINE";LN+(
     L*10):STOP
21   40 NEXT L:SYS40744
F9   50 DATA 82,82,82,82,82,82,82
     ,82,82,87,32,32,32,32,32,32,
     1017
29   60 DATA 32,32,32,32,32,32,32
     ,32,32,32,32,32,32,32,32,32,
     512
FF   70 DATA 32,32,32,32,32,32,32
     ,32,37,37,37,37,37,37,37,37,
     552
70   80 DATA 37,37,87,32,32,32,32
     ,32,32,32,32,32,32,32,32,32,
     577
CF   90 DATA 32,32,32,32,32,32,32
     ,32,32,32,32,32,32,32,32,32,
     512
44   100 DATA 37,37,37,37,37,37,3
     7,37,37,37,37,87,32,32,32,32
     ,622
5B   110 DATA 32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,512
69   120 DATA 32,32,32,32,32,32,3
     2,32,37,37,37,37,37,37,37,37
     ,552
E4   130 DATA 37,37,37,27,82,82,8
     2,82,82,82,82,82,82,82,82,82
     ,1122
92   140 DATA 82,82,82,82,82,82,8
     2,82,82,82,82,82,82,82,82,82
     ,1312
8F   150 DATA 0,0,0,64,128,38,0,0
     ,240,0,1,120,0,66,120,0,777
D0   160 DATA 132,216,1,77,252,1,
     35,246,2,16,240,18,8,254,33,
     255,1786
B5   170 DATA 241,255,14,1,33,255
     ,254,18,11,252,2,19,252,1,34
     ,100,1742
70   180 DATA 1,71,254,0,137,153,
     0,79,255,0,1,252,0,7,216,0,1
     426
43   190 DATA 31,28,0,0,124,8,0,0
     ,240,0,1,120,0,66,120,0,738
A8   200 DATA 132,216,1,77,252,1,
     35,246,2,16,240,18,8,254,33,
     255,1786
FD   210 DATA 241,255,14,1,33,255
     ,254,18,11,252,2,19,252,1,34
     ,100,1742
44   220 DATA 1,71,254,0,137,153,
     0,79,255,0,1,252,0,7,223,0,1
     433
C4   230 DATA 7,7,0,31,28,255,0,0
     ,240,0,1,120,0,66,120,0,875
80   240 DATA 132,216,1,77,252,1,
     35,246,2,16,240,18,8,254,33,
     255,1786
05   250 DATA 241,255,14,1,33,255
     ,254,18,11,252,2,19,252,1,34
     ,100,1742
98   260 DATA 1,71,254,0,137,153,
     0,79,255,0,1,255,0,1,255,0,1
     462
57   270 DATA 1,193,0,7,192,0,0,0
     ,240,0,1,120,0,66,120,0,940
D9   280 DATA 132,216,1,77,252,1,
     35,246,2,16,240,18,8,254,33,
     255,1786
7A   290 DATA 241,255,14,1,33,255
     ,254,18,11,252,2,19,252,1,34
     ,100,1742
7C   300 DATA 1,71,254,0,137,153,
     0,79,255,0,1,252,0,0,112,0,1
     315
C4   310 DATA 0,112,0,1,240,247,0
     ,0,240,0,33,120,0,66,120,0,1
     179
52   320 DATA 196,216,1,77,252,2,
     67,246,2,64,240,2,64,254,1,2
     55,1939
B7   330 DATA 241,3,195,227,1,254
     ,14,2,66,252,2,67,252,2,66,1
     00,1744
B4   340 DATA 1,71,254,0,201,153,
     0,71,255,0,33,252,0,7,216,0,
     1514
8D   350 DATA 31,28,0,0,124,8,0,0
     ,240,0,33,120,0,66,120,0,770
9A   360 DATA 195,216,1,77,252,2,
     67,246,2,64,240,2,64,254,1,2
     55,1939
AF   370 DATA 241,3,195,227,1,254
     ,14,2,66,252,2,67,252,2,66,1
     00,1744
6A   380 DATA 1,71,254,0,201,153,
     0,71,255,0,33,252,0,7,223,0,
     1521
FE   390 DATA 7,7,0,31,28,255,0,0
     ,240,0,33,120,0,66,120,0,907
02   400 DATA 196,216,1,77,252,2,
     67,246,2,64,240,2,64,254,1,2
     55,1939
87   410 DATA 241,3,195,227,1,254
     ,14,2,66,252,2,67,252,2,66,1
     00,1744
82   420 DATA 1,71,254,0,201,153,
     0,71,255,0,33,255,0,1,255,0,
     1550
D7   430 DATA 1,193,0,7,192,190,0
     ,0,240,0,33,120,0,66,120,0,1
     162
4A   440 DATA 196,216,1,77,252,2,
     67,246,2,64,240,2,64,254,1,2
     55,1939
3F   450 DATA 241,3,195,227,1,254
     ,14,2,66,252,2,67,252,2,66,1
     00,1744
01   460 DATA 1,71,254,0,201,153,
     0,71,255,0,33,252,0,0,112,0,
     1403
51   470 DATA 0,112,0,1,240,255,1
     5,0,0,30,132,0,30,66,0,27,90
     8
31   480 DATA 35,0,63,178,128,111
     ,194,64,15,2,64,127,2,64,143
     ,255,1445
84   490 DATA 128,199,195,192,112
     ,127,128,63,66,64,63,194,64,
     38,66,64,1763
E5   500 DATA 127,226,128,153,147
     ,0,255,226,0,63,132,0,14,0,0
     ,14,1485
9B   510 DATA 0,0,15,128,0,255,15
     ,0,0,30,132,0,30,66,0,27,698
B0   520 DATA 35,0,63,178,128,111
     ,194,64,15,2,64,127,2,64,143
     ,255,1445
25   530 DATA 128,199,195,192,112
     ,127,128,63,66,64,63,194,64,
     38,66,64,1763
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27  540 DATA 127,226,128,153,147
    ,0,255,226,0,255,132,0,255,1
    28,0,131,2163
88  550 DATA 128,0,3,224,0,255,1
    5,0,0,30,132,0,30,66,0,27,91
    0
98  560 DATA 35,0,63,178,128,111
    ,194,64,15,2,64,127,2,64,143
    ,255,1445
8D  570 DATA 128,199,195,192,112
    ,127,128,63,66,64,63,194,64,
    38,66,64,1763
F0  580 DATA 127,226,128,153,147
    ,0,255,226,0,63,132,0,251,22
    4,0,224,2156
ED  590 DATA 224,0,56,248,0,255,
    15,0,0,30,132,0,30,66,0,27,1
    083
80  600 DATA 35,0,63,178,128,111
    ,194,64,15,2,64,127,2,64,143
    ,255,1445
75  610 DATA 128,199,195,192,112
    ,127,128,63,66,64,63,194,64,
    38,66,64,1763
44  620 DATA 127,226,128,153,147
    ,0,255,226,0,63,132,0,27,224
    ,0,56,1764
36  630 DATA 248,0,62,0,0,255,15
    ,0,0,30,128,0,30,66,0,27,861

CB  640 DATA 33,0,63,178,128,111
    ,196,128,15,8,64,127,16,72,1
    43,255,1537
24  650 DATA 132,128,112,255,127
    ,255,132,63,208,72,63,200,64
    ,38,68,128,2045
0C  660 DATA 127,226,128,153,145
    ,0,255,242,0,63,128,0,14,0,0
    ,14,1495
9E  670 DATA 0,0,15,128,0,95,15,
    0,0,30,128,0,30,66,0,27,534
83  680 DATA 33,0,63,178,128,111
    ,196,128,15,8,64,127,16,72,1
    43,255,1537
AC  690 DATA 132,128,112,255,127
    ,255,132,63,208,72,63,200,64
    ,38,68,128,2045
47  700 DATA 127,226,128,153,145
    ,0,255,242,0,255,128,0,255,1
    28,0,131,2173
6E  710 DATA 128,0,3,224,0,255,1
    5,0,0,30,128,0,30,66,0,27,90
    6
18  720 DATA 33,0,63,178,128,111
    ,196,128,15,8,64,127,16,72,1
    43,255,1537
74  730 DATA 132,128,112,255,127
    ,255,132,63,208,72,63,200,64
    ,38,68,128,2045
28  740 DATA 127,226,128,153,145
    ,0,255,242,0,63,128,0,251,22
    4,0,224,2166
90  750 DATA 224,0,56,248,0,0,15
    ,0,0,30,128,0,30,66,0,27,824

03  760 DATA 33,0,63,178,128,111
    ,196,128,15,8,64,127,16,72,1
    43,255,1537
83  770 DATA 132,128,112,255,127
    ,255,132,63,208,72,63,200,64
    ,38,68,128,2045
97  780 DATA 127,226,128,153,145
    ,0,255,242,0,63,128,0,27,224
    ,0,56,1774
CE  790 DATA 248,0,62,0,0,0,0,0,
    0,0,0,0,0,0,0,0,310
36  800 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,5,64,8,2,160,239
9C  810 DATA 4,15,255,255,2,160,
    4,5,64,8,0,0,0,0,0,0,772
A4  820 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
92  830 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
76  840 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,16,2,160,32,5,215
AD  850 DATA 64,255,255,240,32,5
    ,64,16,2,160,0,0,0,0,0,0,109
    3
8C  860 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
38  870 DATA 0,0,0,0,0,0,0,12,0,
    0,63,0,0,45,0,0,120
90  880 DATA 127,128,0,45,0,0,30
    ,4,0,12,28,0,146,56,3,255,83
    4
C5  890 DATA 240,15,255,224,12,9
    1,64,24,127,128,0,204,192,1,
    179,96,1852
DE  900 DATA 1,255,224,3,251,240
    ,0,115,128,0,115,192,0,48,0,
    0,1572
57  910 DATA 112,0,0,240,0,166,0
    ,48,0,0,252,0,0,180,0,1,999
77  920 DATA 254,0,0,180,0,32,12
    0,0,56,48,0,24,73,0,31,127,9
    45
F4  930 DATA 192,15,255,240,3,25
    0,48,1,254,24,3,51,0,6,205,1
    28,1675
9F  940 DATA 7,255,128,15,223,19
    2,1,206,0,3,206,0,0,12,0,0,1
    248
A3  950 DATA 14,0,0,15,0,247,0,0
    ,0,0,0,0,0,0,0,0,276
A1  960 DATA 0,0,0,0,0,0,0,0,0,2
    8,0,0,127,0,0,255,410
E4  970 DATA 128,1,207,192,1,135
    ,192,1,207,192,0,255,128,0,1
    27,0,1766
50  980 DATA 0,28,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,28
8A  990 DATA 0,0,0,0,0,127,0,0,0
    ,0,0,0,0,0,0,0,127
A6  1000 DATA 0,0,14,231,24,10,1
    64,33,10,164,33,12,199,24,25
    ,172,1115
55  1010 DATA 8,25,175,115,0,0,0
    ,0,0,0,31,0,25,4,96,32,511
FF  1020 DATA 4,144,32,4,144,24,
    12,144,8,12,96,112,0,0,0,0,7
    36
41  1030 DATA 0,0,0,0,0,255,0,0,
    0,0,0,0,0,0,0,0,255
4D  1040 DATA 0,0,199,51,156,4,3
    4,144,4,34,144,199,35,28,76,
    102,1210
30  1050 DATA 176,140,102,188,0,
    0,0,0,0,0,243,14,124,68,138,
    16,1209
F8  1060 DATA 68,138,16,71,140,1
    6,204,154,48,204,154,48,0,0,
    0,0,1261
73  1070 DATA 0,0,0,0,0,119,0,0,
    0,0,0,0,0,0,0,0,119
A4  1080 DATA 0,0,0,0,0,0,0,0,0,
    5,0,0,5,64,0,13,87
C2  1090 DATA 64,0,63,64,0,15,64
    ,0,15,0,0,6,64,0,10,128,493
93  1100 DATA 0,37,128,0,218,128
    ,0,42,128,0,21,0,0,5,0,0,707

02  1110 DATA 5,0,0,21,0,35,0,0,
    0,0,0,0,0,0,0,0,61
18  1120 DATA 0,0,0,0,0,0,0,0,0,
    0,0,3,0,8,1,64,76
24  1130 DATA 4,15,255,255,1,64,
    4,3,0,8,0,0,0,0,0,0,609
EB  1140 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0,0
98  1150 DATA 0,0,0,0,0,83,0,0,0
    ,21,65,80,85,85,84,106,609
8C  1160 DATA 86,164,91,85,180,2
    7,85,180,27,85,180,27,85,180
    ,27,85,1594
06  1170 DATA 180,27,85,180,27,1
    09,180,27,109,180,27,171,180
    ,27,155,180,1844
06  1180 DATA 26,154,180,26,86,1
    80,21,69,80,5,69,64,0,0,0,0,
    960
96  1190 DATA 0,0,0,0,0,1,0,0,0,
    4,1,0,5,85,0,6,102
A7  1200 DATA 165,0,5,181,0,1,18
    0,0,1,180,0,1,180,0,1,180,10
    75
19  1210 DATA 0,1,180,0,1,180,0,
    1,180,0,1,180,0,1,180,0,905
03  1220 DATA 6,164,0,6,165,0,5,
    85,0,1,84,0,0,0,0,0,516
32  1230 DATA 0,0,0,0,0,255,0,0,
    0,4,16,0,5,80,0,6,366
95  1240 DATA 208,0,6,208,0,6,20
    8,0,6,208,0,6,208,0,6,208,12
    78
C5  1250 DATA 0,6,208,0,6,208,0,
    6,208,0,6,213,0,6,255,64,118
    6
21  1260 DATA 6,170,64,6,150,64,
    5,85,64,1,65,0,0,0,0,0,680
C8  1270 DATA 0,0,0,0,0,255,0,0,
    0,0,80,0,1,84,0,5,425
CC  1280 DATA 165,0,22,169,64,26
    ,250,208,27,86,208,27,86,208
    ,27,86,1659
CD  1290 DATA 208,26,170,208,26,
    170,208,27,86,208,27,86,208,
    91,86,208,2043
49  1300 DATA 106,90,148,106,90,
    148,85,5,84,20,1,64,0,0,0,0,
    947
CC  1310 DATA 0,0,0,0,0,255,0,0,
    0,5,69,64,21,69,80,26,589
F9  1320 DATA 86,180,26,154,180,
    27,155,180,27,171,180,27,109
    ,180,27,109,1818
47  1330 DATA 180,27,85,180,27,8
    5,180,27,85,180,27,85,180,27
    ,85,180,1704
39  1340 DATA 106,86,164,106,86,
    164,85,85,84,21,65,80,0,0,0,
    0,1132
F5  1350 DATA 0,0,0,0,0,4,0,0,0,
    5,5,64,21,85,80,26,290
C0  1360 DATA 170,144,27,239,144
    ,20,109,80,0,109,0,0,109,0,0
    ,109,1260
D2  1370 DATA 0,0,109,0,0,109,0,
    0,109,0,0,109,0,1,109,0,546
2D  1380 DATA 1,169,64,1,169,64,
    1,85,64,0,85,0,0,0,0,0,703
80  1390 DATA 0,0,0,0,0,255,0,0,
    0,1,84,0,5,85,0,6,436
D3  1400 DATA 169,0,6,249,0,6,21
    3,0,6,208,0,6,212,0,6,164,12
    45
E6  1410 DATA 0,6,164,0,6,212,0,
    6,208,0,6,213,0,6,255,64,114
    6
47  1420 DATA 6,170,64,6,170,64,
    5,85,64,1,85,0,0,0,0,0,720
92  1430 DATA 0,0,0,0,0,255,60,0
    ,240,235,3,172,58,206,160,58
    ,1447
CC  1440 DATA 137,176,13,138,128
    ,14,170,192,3,187,0,0,48,0,6
    ,186,1398
8F  1450 DATA 64,26,170,144,42,1
    70,144,105,170,164,165,105,1
    68,164,105,168,2076
7C  1460 DATA 165,106,168,169,17
    0,168,170,170,164,106,170,14
    4,42,170,144,26,2252
4E  1470 DATA 170,64,6,185,0,255
    ,0,0,0,20,0,0,85,0,0,109,894

14  1480 DATA 0,0,109,0,0,109,0,
    0,109,0,0,109,0,0,109,20,565

76  1490 DATA 20,109,85,85,107,9
    1,105,106,219,109,110,218,23
    7,110,214,237,2162
CC  1500 DATA 110,214,173,106,21
    5,180,107,94,148,85,122,80,8
    5,105,64,1,1889
1F  1510 DATA 165,0,0,84,0,5,248
    ,0,0,35,0,0,0,0,0,34,572
9F  1520 DATA 60,68,34,66,68,0,0
    ,0,34,66,68,34,126,68,0,0,69
    2
2E  1530 DATA 0,36,66,40,248,198
    ,16,0,0,0,0,0,0,0,0,604
BE  1540 DATA 255,255,255,0,0,0,
    255,255,255,0,0,0,0,0,0,0,15
    30
A2  1550 DATA 0,0,0,0,0,255,0,16
    ,0,0,16,0,0,0,0,156,443
EC  1560 DATA 16,35,146,16,36,0,
    0,0,146,16,36,146,16,36,0,0,
    645
74  1570 DATA 0,146,16,36,156,31
    ,35,0,0,0,0,0,0,0,0,0,420
46  1580 DATA 255,255,255,0,0,0,
    255,255,255,0,0,0,0,0,0,0,15
    30
BF  1590 DATA 0,0,0,0,0,255,0,0,
    0,0,0,0,0,0,0,132,387
57  1600 DATA 79,128,68,66,0,0,0
    ,0,4,66,0,199,194,0,0,0,804
76  1610 DATA 0,132,66,0,140,198
    ,32,0,0,0,0,0,0,0,0,0,568
92  1620 DATA 255,255,224,0,0,0,
    255,255,224,0,0,0,0,0,0,0,14
    68
3A  1630 DATA 0,0,0,0,0,255,255,
    255,255,255,255,255,255,255,
    255,255,2805
81  1640 DATA 255,255,255,255,25
    5,255,255,255,255,255,255,25
    5,255,255,255,255,4080
97  1650 DATA 255,255,255,255,25
    5,255,255,255,255,255,255,25
    5,255,255,255,255,4080
2D  1660 DATA 255,255,255,255,25
    5,255,255,255,255,255,255,25
    5,255,255,255,255,4080
44  1670 DATA 255,255,255,255,25
    5,85,0,0,0,0,0,80,0,1,80,0,1
    521
74  1680 DATA 5,64,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,94
    2
85  1690 DATA 208,0,5,0,0,10,0,0
    ,41,128,0,41,128,0,182,160,9
    03
90  1700 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,80,1,64,20,0,
    1176
11  1710 DATA 0,4,0,0,0,190,0,0,
    0,0,0,80,0,1,80,0,355
6C  1720 DATA 5,64,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,94
    2
0D  1730 DATA 208,0,5,0,0,10,0,0
    ,41,128,0,41,128,0,182,160,9
    03
9E  1740 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,64,0,5,0,0,10
    80
67  1750 DATA 5,0,0,21,0,255,0,0
    ,0,0,0,0,0,1,80,0,362
1D  1760 DATA 5,80,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,95
    8
DD  1770 DATA 208,0,5,0,0,10,0,0
    ,41,128,0,42,64,0,173,96,767

AC  1780 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,80,0,21,80,0,
    1192
08  1790 DATA 20,16,0,84,0,255,0
    ,0,0,0,0,80,0,1,80,0,536
E6  1800 DATA 5,64,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,94
    2
84  1810 DATA 208,0,5,0,0,10,0,0
    ,41,128,0,41,128,0,182,160,9
    03
78  1820 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,64,0,85,80,0,
    1240
DA  1830 DATA 80,80,1,81,64,255,
    0,0,0,0,0,80,0,1,80,0,722
7D  1840 DATA 5,64,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,94
    2
43  1850 DATA 208,0,5,0,0,10,0,0
    ,41,128,0,38,128,0,186,160,9
    04
2C  1860 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,64,0,85,0,1,1
    161
C1  1870 DATA 81,64,0,5,64,255,0
    ,0,0,0,0,0,0,0,0,0,469
8C  1880 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
5A  1890 DATA 0,4,1,84,16,6,160,
    101,85,85,16,6,160,4,1,84,81
    3
E0  1900 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
DC  1910 DATA 0,0,0,0,0,255,0,0,
    0,0,1,64,0,5,64,0,389
59  1920 DATA 5,0,0,21,64,0,93,6
    4,0,127,64,0,221,192,0,255,1
    106
43  1930 DATA 192,0,55,0,0,110,6
    4,1,166,144,5,170,148,60,166
    ,132,1413
DA  1940 DATA 12,170,143,0,255,2
    04,0,85,64,0,21,0,0,17,0,0,9
    71
93  1950 DATA 81,64,1,81,80,95,0
    ,0,0,0,0,0,0,0,0,0,402
3C  1960 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
0C  1970 DATA 0,21,64,16,10,144,
    4,85,85,89,10,144,4,21,64,16
    ,777
10  1980 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
B9  1990 DATA 0,0,0,0,0,255,0,0,
    0,5,0,0,5,64,0,1,330
D3  2000 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

1D  2010 DATA 0,0,80,0,0,160,0,2
    ,104,0,2,152,0,10,174,0,684
1D  2020 DATA 10,170,0,15,255,0,
    5,85,0,1,84,0,0,85,0,1,711
1C  2030 DATA 69,64,1,80,0,0,0,0
    ,0,5,0,0,5,64,0,1,289
7B  2040 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

8B  2050 DATA 0,0,80,0,0,160,0,2
    ,104,0,2,104,0,10,158,0,620
29  2060 DATA 10,170,0,15,255,0,
    5,85,0,1,84,0,5,85,0,5,720
30  2070 DATA 5,0,1,69,64,0,0,0,
    0,0,0,0,5,64,0,5,213
FA  2080 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

E1  2090 DATA 0,0,80,0,0,160,0,2
    ,104,0,1,168,0,9,122,0,646
63  2100 DATA 10,170,0,15,255,0,
    5,85,0,5,84,0,5,84,0,4,722
F8  2110 DATA 20,0,0,21,0,0,0,0,
    0,5,0,0,5,64,0,1,116
C2  2120 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

DB  2130 DATA 0,0,80,0,0,160,0,2
    ,104,0,2,104,0,10,158,0,620
B1  2140 DATA 10,170,0,15,255,0,
    5,85,0,1,84,0,0,80,0,0,705
6E  2150 DATA 80,0,0,84,0,0,0,0,
    0,5,0,0,5,64,0,1,239
CA  2160 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

73  2170 DATA 0,0,80,0,0,160,0,2
    ,104,0,2,104,0,10,158,0,620
BF  2180 DATA 10,170,0,15,255,0,
    5,85,0,5,84,0,20,1,64,16,730

4E  2190 DATA 0,0,0,0,0,166,0,0,
    0,0,80,0,0,84,0,0,330
7D  2200 DATA 20,0,0,85,0,0,85,6
    4,12,85,64,4,213,192,4,255,1
    083
51  2210 DATA 192,5,63,0,1,106,6
    4,0,170,144,0,170,151,0,170,
    131,1367
03  2220 DATA 0,42,0,0,255,192,0
    ,85,64,0,21,0,1,81,0,0,741
3F  2230 DATA 1,0,0,1,64,247,0,0
    ,0,0,1,64,0,5,64,0,447
B9  2240 DATA 5,0,0,21,64,0,85,6
    4,0,85,76,0,213,196,0,255,10
    64
2B  2250 DATA 196,0,63,20,0,106,
    80,1,170,128,53,170,128,48,1
    70,128,1461
A1  2260 DATA 0,42,0,0,255,192,0
    ,85,64,0,21,0,0,17,80,0,756
2C  2270 DATA 16,0,0,80,0,127,0,
    0,0,0,0,80,0,1,80,0,384
72  2280 DATA 5,64,0,21,64,0,63,
    64,0,55,80,0,255,208,0,63,94
    2
65  2290 DATA 208,4,5,0,16,42,0,
    169,121,128,16,149,128,4,166
    ,160,1316
E0  2300 DATA 0,170,160,0,255,24
    0,0,85,80,0,21,64,0,5,0,0,10
    80
70  2310 DATA 5,0,0,21,0,255,0,0
    ,0,5,0,0,5,64,0,1,356
D5  2320 DATA 80,0,1,84,0,1,252,
    0,5,220,0,7,255,0,7,252,1164

86  2330 DATA 0,0,80,16,0,168,4,
    2,109,106,2,86,4,10,154,16,7
    57
BA  2340 DATA 10,170,0,15,255,0,
    5,85,0,1,84,0,0,80,0,0,705
09  2350 DATA 80,0,0,84,0,119,15
    ,0,4,30,128,8,30,64,16,27,60
    5
69  2360 DATA 32,32,63,176,64,11
    1,192,128,15,1,0,25,34,0,57,
    148,1078
B6  2370 DATA 0,60,204,0,62,50,0
    ,63,224,0,63,192,0,32,64,0,1
    014
A8  2380 DATA 127,224,0,128,16,0
    ,255,240,0,63,128,0,14,0,0,1
    4,1209
56  2390 DATA 0,0,15,128,0,35,15
    ,0,0,30,128,0,30,64,2,27,474

B5  2400 DATA 32,4,63,176,24,111
    ,192,32,15,0,64,25,33,128,57
    ,146,1102
41  2410 DATA 0,57,204,0,60,52,0
    ,63,226,0,63,192,0,32,64,0,1
    013
3F  2420 DATA 127,224,0,128,16,0
    ,255,240,0,63,128,0,27,224,0
    ,56,1489
30  2430 DATA 248,0,62,0,0,83,15
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     ,0,0,30,128,0,30,64,0,27,687
75   2440 DATA 32,0,63,176,1,111,
     192,6,15,0,24,25,16,96,57,13
     7,951
B3   2450 DATA 128,57,206,0,56,52
     ,0,63,228,0,63,196,0,32,64,0
     ,1145
6D   2460 DATA 127,224,0,128,16,0
     ,255,240,0,63,128,0,251,224,
     0,224,1880
25   2470 DATA 224,0,56,248,0,53,
     15,0,0,30,128,0,30,64,0,27,8
     75
55   2480 DATA 32,0,63,176,0,111,
     192,0,15,0,0,25,0,0,51,136,8
     01
81   2490 DATA 0,51,200,0,56,63,2
     55,63,232,0,63,200,0,32,64,0
     ,1279
8F   2500 DATA 127,224,0,128,16,0
     ,255,240,0,255,128,0,255,128
     ,0,131,1887
F1   2510 DATA 128,0,3,224,0,80,3
     2,0,240,16,1,120,8,2,120,4,9
     78
B6   2520 DATA 4,216,2,13,252,1,3
     ,246,0,128,240,0,68,152,0,41
     ,1366
FA   2530 DATA 156,0,51,60,0,76,1
     24,0,7,252,0,3,252,0,2,4,987
7F   2540 DATA 0,7,254,0,8,1,0,15
     ,255,0,1,252,0,0,112,0,905
93   2550 DATA 0,112,0,1,240,53,0
     ,0,240,0,1,120,64,2,120,32,9
     85
63   2560 DATA 4,216,24,13,252,4,
     3,246,2,0,240,1,132,152,0,73
     ,1362
13   2570 DATA 156,0,51,156,0,44,
     60,0,71,252,0,3,252,0,2,4,10
     51
E4   2580 DATA 0,7,254,0,8,1,0,15
     ,255,0,1,252,0,7,216,0,1016
FB   2590 DATA 31,28,0,0,124,33,0
     ,0,240,0,1,120,0,2,120,0,699
F2   2600 DATA 4,216,128,13,252,9
     6,3,246,24,0,240,6,8,152,1,1
     45,1534
AE   2610 DATA 156,0,115,156,0,44
     ,28,0,39,252,0,35,252,0,2,4,
     1083
44   2620 DATA 0,7,254,0,8,1,0,15
     ,255,0,1,252,0,7,223,0,1023
7E   2630 DATA 7,7,0,31,28,87,0,0
     ,240,0,1,120,0,2,120,0,643
F9   2640 DATA 4,216,0,13,252,0,3
     ,246,0,0,240,0,0,152,0,17,11
     43
A0   2650 DATA 204,0,19,204,255,2
     52,28,0,23,252,0,19,252,0,2,
     4,1514
C2   2660 DATA 0,7,254,0,8,1,0,15
     ,255,0,1,255,0,1,255,0,1052
B6   2670 DATA 1,193,0,7,192,84,0
     ,0,0,0,0,0,0,0,0,0,477
62   2680 DATA 0,0,0,0,0,0,0,0,0,0,
     28,0,0,127,0,0,255,410
A9   2690 DATA 128,1,207,192,1,13
     5,192,1,207,192,0,255,128,0,
     127,0,1766
11   2700 DATA 0,28,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,28
9B   2710 DATA 0,0,0,0,0,141,0,0,
     0,0,0,0,0,0,0,0,141
7A   2720 DATA 0,0,0,0,0,0,0,0,0,0,
     28,0,0,127,0,0,255,410
4C   2730 DATA 128,1,249,192,1,24
     0,192,1,249,192,0,255,128,0,
     127,0,1955
99   2740 DATA 0,28,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,28
19   2750 DATA 0,0,0,0,0,76,0,2,0
     ,128,7,0,64,15,128,32,452
1E   2760 DATA 18,73,18,31,201,12
     ,24,198,14,10,134,23,8,140,3
     ,255,1162
07   2770 DATA 252,1,176,112,0,12
     7,224,0,56,224,0,63,192,0,63
     ,224,1714
5D   2780 DATA 0,120,240,0,146,72
     ,0,199,24,0,121,224,4,224,11
     2,7,1493
D1   2790 DATA 128,26,1,128,28,16
     6,0,0,0,0,0,0,0,0,0,0,477
69   2800 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
FC   2810 DATA 0,10,128,16,5,64,1
     2,31,255,255,5,64,12,10,128,
     16,1011
5C   2820 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
4A   2830 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
B0   2840 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
71   2850 DATA 0,8,1,80,48,2,160,
     255,255,248,48,2,160,8,1,80,
     1356
A4   2860 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
12   2870 DATA 0,0,0,0,0,35,0,0,0
     ,0,1,64,0,5,64,0,169
65   2880 DATA 5,0,0,21,64,0,93,6
     4,0,127,64,0,221,192,0,255,1
     106
3F   2890 DATA 192,0,55,0,0,110,6
     4,1,166,144,5,170,148,60,166
     ,132,1413
EE   2900 DATA 12,170,143,0,255,2
     04,0,85,64,0,21,0,1,17,0,1,9
     73
E4   2910 DATA 81,64,0,1,80,35,0,
     0,0,255,255,255,255,255,255,
     255,2046
D4   2920 DATA 255,255,255,0,0,0,
     252,215,55,220,35,33,0,236,5
     5,230,2096
77   2930 DATA 35,65,82,83,69,84,
     49,32,83,84,65,32,86,73,67,1
     70,1159
D4   2940 DATA 50,0,244,55,240,35
     ,82,84,83,0,250,55,250,35,33
     ,0,1496
8F   2950 DATA 9,56,4,36,65,82,42
     ,170,170,17,0,0,0,0,248,124,
     1023
DE   2960 DATA 102,102,126,102,23
     8,0,252,126,102,102,124,102,
     254,0,252,126,2110
29   2970 DATA 98,96,98,102,254,0
     ,248,124,102,102,102,110,254
     ,0,248,124,2062
61   2980 DATA 98,104,120,98,254,
     0,252,126,96,96,120,96,248,0
     ,252,126,2086
58   2990 DATA 98,96,110,102,254,
     0,228,102,102,102,126,102,23
     8,0,60,24,1744
57   3000 DATA 24,24,24,24,126,0,
     8,12,12,12,108,108,254,0,228
     ,102,1066
72   3010 DATA 108,120,120,108,23
     8,0,224,48,48,48,48,50,254,0
     ,228,126,1768
1E   3020 DATA 86,70,70,70,206,0,
     228,102,118,94,78,70,238,0,2
     48,124,1802
7E   3030 DATA 102,66,66,102,254,
     0,252,126,102,102,126,96,254
     ,0,252,102,2002
4A   3040 DATA 66,82,90,254,12,0,
     252,126,102,102,124,102,230,
     0,252,102,1896
B6   3050 DATA 96,60,6,70,254,0,2
     54,152,24,24,24,24,60,0,100,
     102,1250
7A   3060 DATA 102,102,102,102,25
     4,0,228,102,102,102,102,124,
     254,0,226,99,2001
F0   3070 DATA 99,107,127,119,227
     ,0,228,102,60,24,60,102,238,
     0,228,102,1823
6C   3080 DATA 102,126,24,24,126,
     0,252,126,12,24,48,98,254,0,
     87,87,1390
7B   3090 DATA 87,87,85,85,86,85,
     69,85,85,85,165,105,170,105,
     87,87,1559
9E   3100 DATA 87,87,85,85,5,1,68
     ,85,85,105,190,190,190,190,0
     ,0,1453
4C   3110 DATA 0,0,0,24,255,0,0,0
     ,0,0,0,0,0,0,254,191,724
62   3120 DATA 175,5,0,0,0,0,102,
     102,102,0,0,0,0,0,3,15,504
26   3130 DATA 60,246,246,60,15,3
     ,0,0,0,170,170,0,0,0,1,5,976
4C   3140 DATA 21,170,170,21,5,1,
     85,84,80,170,170,80,84,85,0,
     0,1226
88   3150 DATA 4,0,0,3,0,128,0,12
     8,0,0,32,0,0,12,255,255,817
D1   3160 DATA 195,0,48,12,1,16,8
     5,85,85,85,81,85,85,85,125,8
     5,1158
81   3170 DATA 85,69,69,85,85,85,
     255,255,255,119,85,85,0,0,0,
     0,1532
5C   3180 DATA 0,240,0,0,0,0,68,8
     5,85,85,85,69,85,85,255,255,
     1397
84   3190 DATA 255,255,255,119,87
     ,71,124,102,110,126,118,102,
     126,0,16,48,1914
41   3200 DATA 120,24,24,24,254,0
     ,56,124,108,12,56,98,254,0,5
     6,124,1334
31   3210 DATA 102,6,28,70,126,0,
     12,30,54,102,127,6,62,0,124,
     126,975
10   3220 DATA 96,126,6,70,126,0,
     124,126,96,124,102,102,126,0
     ,124,126,1474
24   3230 DATA 12,24,126,24,60,0,
     124,102,102,50,102,102,126,0
     ,124,70,1158
8B   3240 DATA 70,124,12,12,30,0,
     0,0,24,0,0,24,0,0,74,18,388
FE   3250 DATA 4,1,0,0,0,0,252,12
     7,106,106,106,106,106,234,1,
     1,1150
47   3260 DATA 1,1,1,1,255,255,10
     6,90,102,105,106,106,218,230
     ,106,106,1789
75   3270 DATA 106,106,90,102,105
     ,106,149,106,106,106,106,106
     ,105,106,85,170,1761
C6   3280 DATA 170,170,170,170,17
     0,170,149,106,106,106,105,10
     6,106,170,170,106,2251
1C   3290 DATA 106,106,106,42,10,
     2,85,106,106,106,0,128,0,24,
     89,90,1106
99   3300 DATA 214,245,245,245,53
     ,53,101,165,159,159,108,108,
     112,112,53,53,2185
36   3310 DATA 53,53,53,53,53,253
     ,112,112,112,112,112,112,112
     ,127,150,150,1729
49   3320 DATA 69,69,69,69,69,69,
     69,69,69,69,69,69,117,125,64
     ,64,1198
5B   3330 DATA 64,64,64,64,64,96,
    0,0,0,0,64,144,164,169,20,69
    ,1046
60  3340 DATA 85,86,89,150,85,65
    ,1,5,86,149,102,149,84,64,14
    9,106,1455
AA  3350 DATA 106,106,170,255,63
    ,207,243,252,63,207,243,252,
    85,255,253,253,3013
89  3360 DATA 253,253,253,253,25
    3,170,253,253,253,189,173,10
    5,153,101,86,149,3150
E2  3370 DATA 106,106,106,106,10
    6,106,85,106,106,106,106,106
    ,106,106,255,255,1973
77  3380 DATA 255,255,255,255,17
    0,170,148,101,90,90,90,90,90
    ,90,173,173,2495
CF  3390 DATA 169,233,249,249,25
    3,170,90,90,101,102,105,106,
    106,170,195,195,2583
27  3400 DATA 195,195,125,195,19
    5,195,171,171,175,175,175,19
    1,191,255,234,250,3088
17  3410 DATA 250,250,254,254,25
    5,255,207,243,243,243,252,25
    2,255,255,243,243,3954
87  3420 DATA 207,207,207,63,63,
    255,170,170,169,165,165,149,
    149,221,170,170,2700
B6  3430 DATA 106,90,90,86,85,93
    ,166,149,85,85,85,85,85,215,
    170,170,1845
B0  3440 DATA 170,170,170,170,17
    0,170,186,186,186,213,255,18
    6,186,186,174,174,2952
2E  3450 DATA 174,87,255,174,174
    ,174,255,255,255,255,255,255
    ,255,255,149,106,3333
E8  3460 DATA 106,106,106,106,17
    0,106,91,107,107,90,102,105,
    106,106,106,90,1710
FF  3470 DATA 102,105,106,250,62
    ,207,153,150,154,106,154,154
    ,154,154,90,102,2203
C6  3480 DATA 101,102,102,102,23
    0,230,154,154,218,255,243,25
    2,85,255,154,155,2792
65  3490 DATA 159,255,243,252,85
    ,255,86,102,105,102,102,102,
    102,102,154,154,2360
02  3500 DATA 154,101,154,154,15
    4,154,154,154,154,255,243,25
    2,85,255,3,3,2429
83  3510 DATA 15,15,63,175,243,2
    54,63,3,0,0,0,0,0,0,192,192,
    1215
E8  3520 DATA 240,240,252,248,23
    9,191,252,192,0,0,0,0,0,0,25
    5,255,2364
C9  3530 DATA 255,207,255,255,25
    5,255,207,255,111,102,102,10
    2,102,102,255,243,3063
67  3540 DATA 255,191,154,154,15
    4,154,252,207,255,250,154,15
    4,154,154,86,85,2813
DA  3550 DATA 93,93,93,93,93,93,
    93,93,93,93,93,149,101,102,0
    ,192,1567
98  3560 DATA 232,238,236,172,20
    6,236,243,192,0,132,194,48,1
    ,14,221,186,2551
84  3570 DATA 186,255,239,175,17
    5,175,85,170,170,207,243,204
    ,243,204,95,163,2989
B4  3580 DATA 172,171,168,171,17
    0,170,255,255,63,252,62,254,
    59,171,190,190,2773
32  3590 DATA 190,231,255,190,19
    0,190,85,170,255,215,215,215
    ,255,255,7,131,3049
0A  3600 DATA 153,153,129,153,17
    ,255,3,129,153,153,131,153,1
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91  3610 DATA 157,159,157,153,1,
    255,7,131,153,153,153,145,1,
    255,7,131,2018
FA  3620 DATA 157,151,135,157,1,
    255,3,129,159,159,135,159,7,
    255,3,129,1994
55  3630 DATA 157,159,145,153,1,
    255,27,153,153,153,129,153,1
    7,255,195,231,2336
42  3640 DATA 231,231,231,231,12
    9,255,247,243,243,243,147,14
    7,1,255,27,153,3014
88  3650 DATA 147,135,135,147,17
    ,255,31,207,207,207,207,205,
    1,255,27,129,2312
89  3660 DATA 169,185,185,185,49
    ,255,27,153,137,161,177,185,
    17,255,7,131,2278
D0  3670 DATA 153,189,189,153,1,
    255,3,129,153,153,129,159,1,
    255,3,153,2078
AB  3680 DATA 189,173,165,1,243,
    255,3,129,153,153,131,153,25
    ,255,3,153,2184
0A  3690 DATA 159,195,249,185,1,
    255,1,103,231,231,231,231,19
    5,255,155,153,2830
32  3700 DATA 153,153,153,153,1,
    255,27,153,153,153,153,131,1
    ,255,29,156,2079
90  3710 DATA 156,148,128,136,28
    ,255,27,153,195,231,195,153,
    17,255,27,153,2257
F1  3720 DATA 153,129,231,231,12
    9,255,3,129,243,231,207,157,
    1,255,247,247,2848
68  3730 DATA 223,223,127,47,243
    ,252,223,223,247,247,253,251
    ,207,191,170,171,3298
13  3740 DATA 171,171,175,181,14
    4,181,234,122,122,122,126,21
    5,65,215,175,171,2590
95  3750 DATA 171,171,171,171,17
    1,235,255,255,255,255,255,25
    5,255,255,126,122,3378
78  3760 DATA 122,122,122,122,12
    2,122,174,87,255,174,174,174
    ,174,174,252,240,2610
A2  3770 DATA 195,0,0,195,240,25
    2,63,15,195,0,0,195,15,63,86
    ,169,1683
EB  3780 DATA 169,169,169,169,16
    9,169,106,106,106,106,90,102
    ,105,106,255,255,2351
20  3790 DATA 255,0,0,255,255,25
    5,63,63,63,195,195,63,63,63,
    252,252,2292
D5  3800 DATA 252,195,195,252,25
    2,252,149,106,218,38,198,221
    ,253,205,85,170,3041
C2  3810 DATA 164,159,159,127,76
    ,127,252,240,192,204,252,252
    ,252,255,63,15,2789
43  3820 DATA 3,51,63,63,63,255,
    255,252,252,252,204,192,240,
    252,255,63,2715
51  3830 DATA 63,63,51,3,15,63,1
    31,153,145,129,137,153,129,2
    55,239,207,1936
E3  3840 DATA 135,231,231,231,1,
    255,199,131,147,243,199,157,
    1,255,199,131,2746
CC  3850 DATA 153,249,227,185,12
    9,255,243,225,201,153,128,24
    9,193,255,131,129,3105
FA  3860 DATA 159,129,249,185,12
    9,255,131,129,159,131,153,15
    3,129,255,131,129,2606
E3  3870 DATA 243,231,129,231,19
    5,255,131,153,153,195,153,15
    3,129,255,131,153,2890
FA  3880 DATA 153,195,243,243,22
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    5,255,255,255,231,255,255,23
    1,255,255,255,220,3781
1D  3890 DATA 207,103,207,223,25
    2,207,85,169,169,169,169,169
    ,169,170,149,106,2723
08  3900 DATA 106,106,105,103,15
    9,127,85,170,170,170,106,246
    ,253,255,255,220,2636
88  3910 DATA 207,255,0,16,0,2,1
    92,192,243,255,127,243,192,1
    92,247,227,2590
94  3920 DATA 192,128,128,227,19
    2,255,3,3,3,253,254,3,3,3,19
    5,195,2037
E3  3930 DATA 195,125,190,195,19
    5,195,3,3,3,2,0,0,64,2,195,1
    95,1562
5F  3940 DATA 195,130,0,0,128,4,
    81,167,147,157,126,195,195,1
    95,26,6,1752
77  3950 DATA 1,253,254,3,3,3,48
    ,48,204,48,32,0,0,0,48,48,99
    3
F9  3960 DATA 48,207,207,48,48,4
    8,0,32,255,32,0,32,255,32,0,
    5,1249
FE  3970 DATA 255,5,0,5,255,5,10
    5,169,105,105,106,105,102,15
    3,169,164,1808
A8  3980 DATA 144,64,0,0,0,0,170
    ,169,166,154,106,170,170,170
    ,105,105,1693
FD  3990 DATA 105,105,105,100,80
    ,64,85,234,170,234,170,234,1
    70,234,85,171,2346
3B  4000 DATA 170,171,170,171,17
    0,171,86,169,169,169,169,169
    ,169,169,217,192,2701
12  4010 DATA 230,192,217,192,23
    0,224,95,87,23,21,133,5,1,17
    ,191,127,1985
39  4020 DATA 255,255,255,255,25
    5,255,255,253,244,208,64,0,0
    ,0,255,255,3064
B1  4030 DATA 255,255,255,253,24
    4,208,170,169,166,153,107,16
    7,175,159,255,255,3246
B5  4040 DATA 255,255,255,253,24
    4,208,247,227,193,128,193,22
    7,247,255,231,231,3649
AE  4050 DATA 231,0,0,231,231,23
    1,255,255,255,255,255,127,12
    7,95,215,87,2850
0F  4060 DATA 87,95,87,87,87,87,
    106,90,105,101,85,151,151,87
    ,170,90,1666
31  4070 DATA 85,85,245,253,255,
    255,106,42,42,10,10,2,130,0,
    86,171,1778
20  4080 DATA 173,173,179,179,15
    7,157,149,234,58,62,206,206,
    118,118,179,179,2527
BF  4090 DATA 172,172,171,170,17
    0,170,64,0,0,0,0,0,0,85,0,
    1174
3A  4100 DATA 0,0,0,0,0,0,206,20
    6,122,122,234,170,170,170,48
    ,236,1684
BA  4110 DATA 236,176,59,60,60,5
    9,16,100,100,144,25,20,20,25
    ,0,1,1101
F0  4120 DATA 3,7,15,31,63,127,2
    52,252,252,252,252,252,252,2
    52,30,19,2311
85  4130 DATA 25,63,96,248,72,96
    ,225,236,230,192,159,7,183,1
    59,31,19,2041
70  4140 DATA 25,63,96,240,216,3
    2,218,171,218,171,218,171,21
    8,171,255,254,2737
E5  4150 DATA 223,239,247,251,19
    1,255,85,106,106,106,85,166,
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Listings

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    166,166,231,231,2854
E1  4160 DATA 231,0,0,255,255,25
    5,255,255,255,0,0,231,231,23
    1,231,231,2916
77  4170 DATA 231,7,7,231,231,23
    1,63,63,63,63,63,63,63,63,31
    ,31,1504
93  4180 DATA 31,31,31,31,31,31,
    248,248,248,248,248,248,248,
    248,0,0,2170
01  4190 DATA 255,255,255,255,25
    5,255,0,0,0,255,255,255,255,
    255,255,255,3315
FF  4200 DATA 255,255,255,0,0,0,
    252,215,55,220,35,33,0,236,5
    5,230,2096
F0  4210 DATA 35,65,82,83,69,84,
    49,32,83,84,65,32,86,73,67,1
    70,1159
63  4220 DATA 50,0,244,55,240,35
    ,82,84,83,0,250,55,250,35,33
    ,0,1496
BD  4230 DATA 9,56,4,36,65,82,0,
    0,169,0,133,250,169,133,133,
    251,1490
B8  4240 DATA 169,218,133,174,13
    3,193,169,37,133,175,133,194
    ,169,40,133,252,2455
F2  4250 DATA 169,159,133,253,16
    0,0,177,250,145,174,230,250,
    208,2,230,251,2791
09  4260 DATA 230,174,208,2,230,
    175,165,250,197,252,208,234,
    165,251,197,253,3191
E2  4270 DATA 208,228,169,195,13
    3,187,169,159,133,188,169,3,
    133,183,169,0,2426
D8  4280 DATA 133,185,160,0,185,
    147,159,240,6,32,210,255,200
    ,208,245,32,2397
21  4290 DATA 207,255,240,251,20
    1,49,240,4,201,56,48,230,41,
    15,133,186,2357
C5  4300 DATA 76,234,245,147,17,
    17,73,78,80,85,84,32,68,69,8
    6,73,1464
0D  4310 DATA 67,69,32,78,85,77,
    66,69,82,13,17,67,65,83,61,4
    9,980
A5  4320 DATA 32,47,32,68,73,83,
    75,61,32,56,32,79,82,32,57,5
    8,899
D0  4330 DATA 45,32,0,87,84,50,0
    ,0,0,0,0,0,0,0,0,0,298
F4  4340 DATA 0,0,0,255,255,255,
    255,0,0,0,0,0,0,0,0,0,1020
```

PAINLESS WINDOWS

PROGRAM: BORD.LOAD

```
34  1 REM * THIS PROGRAM WILL CR
    EATE    *
28  2 REM * THE C128 PROG 'BORD'
     ONTO   *
92  3 REM * TAPE OR DISK. THIS P
    ROGRAM *
3C  4 REM * SHOULD BE ENTERED AN
    D RUN   *
DA  5 REM * IN C64 MODE. BORD SH
    OULD BE*
AA  6 REM * USED IN C128 MODE ON
    LY      *
DA  10 BL=55    :LN=50    :SA=2867
    2
C0  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A
B7  30 POKE53280,A:POKE SA+L*16+
    D,A:NEXT D
73  40 READ A:IF A<>CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
E3  45 NEXT L:SYS 29382
6E  50 DATA 76,9,12,76,128,12,76
    ,194,12,166,228,232,189,51,1
    92,133,1786
FD  60 DATA 250,189,76,192,133,2
    51,166,229,202,189,51,192,13
    3,252,189,76,2770
31  70 DATA 182,133,253,166,230,
    202,138,24,101,250,133,250,1
    44,2,230,251,2699
42  80 DATA 166,230,202,138,24,1
    01,252,133,252,144,2,230,253
    ,165,231,24,2547
08  90 DATA 229,230,24,105,3,168
    ,169,110,145,252,169,125,145
    ,250,136,168,2429
24  100 DATA 64,145,250,145,252,
    136,208,249,169,109,145,250,
    169,112,145,252,2800
A2  110 DATA 166,229,202,232,189
    ,51,192,133,250,189,76,192,1
    33,251,189,86,2720
5E  120 DATA 164,230,136,145,250
    ,164,231,200,145,250,228,228
    ,208,229,96,224,3138
28  130 DATA 230,167,166,167,224
    ,15,208,3,188,167,96,162,0,1
    81,228,157,2370
26  140 DATA 244,7,232,224,4,208
    ,246,166,167,189,33,13,170,1
    69,4,160,2235
97  150 DATA 0,132,255,160,4,32,
    4,13,160,0,160,0,166,255,169
    ,251,1761
E8  160 DATA 32,118,255,32,202,2
    05,200,208,243,230,252,165,2
    52,197,254,144,2987
C4  170 DATA 235,96,166,167,224,
    0,208,1,96,189,33,13,170,169
    ,4,160,1931
C3  180 DATA 0,132,255,160,4,32,
    4,13,162,0,169,251,141,185,2
    ,32,1540
37  190 DATA 216,205,166,255,32,
    119,255,200,208,245,230,252,
    165,252,197,254,3251
81  200 DATA 144,237,162,0,189,2
    44,7,149,228,232,224,4,208,2
    46,32,50,2356
2C  210 DATA 202,198,167,96,133,
    252,134,253,132,254,24,101,2
    54,133,254,169,2756
B8  220 DATA 0,133,251,162,18,16
    5,253,32,204,205,232,169,0,3
    2,204,205,2265
80  230 DATA 96,0,4,8,12,16,20,2
    4,28,32,36,40,44,48,52,56,51
    6
ED  240 DATA 60,234,234,234,234,
    234,234,234,234,234,234,234,
    234,234,234,234,3570
99  250 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
3C  260 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
A6  270 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
38  280 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
62  290 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
C4  300 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
```

```
EE  310 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
0C  320 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
EA  330 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
8C  340 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
76  350 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
09  360 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234,234,3744
19  370 DATA 67,75,44,51,0,27,10
    ,218,7,131,32,77,69,78,85,32
    ,1023
1A  380 DATA 77,65,75,69,82,44,5
    2,0,47,10,228,7,131,32,83,67
    ,1069
5F  390 DATA 82,79,76,76,66,65,8
    7,73,57,44,53,0,72,10,239,7,
    1089
E9  400 DATA 131,32,70,65,83,84,
    32,70,79,82,77,65,84,84,69,8
    2,1189
B4  410 DATA 44,54,0,92,10,248,7
    ,131,32,67,79,83,77,73,67,32
    ,1096
B4  420 DATA 67,65,86,69,82,78,4
    4,55,0,108,10,2,8,131,32,88,
    925
2F  430 DATA 69,82,79,80,85,83,4
    4,56,0,125,10,12,8,131,32,77
    ,974
00  440 DATA 65,73,78,32,77,69,7
    8,85,44,57,0,0,0,53,53,44,80
    8
05  450 DATA 51,50,44,50,48,55,4
    4,50,53,53,44,50,48,49,44,49
    ,782
0E  460 DATA 51,44,50,48,56,44,4
    9,51,51,57,0,101,14,137,0,13
    1,884
C0  470 DATA 50,52,54,44,51,50,4
    4,49,55,52,44,50,53,53,44,49
    ,794
34  480 DATA 54,57,44,49,51,44,5
    1,50,44,50,49,48,44,49,49,51
    ,784
0E  490 DATA 49,0,139,14,138,96,
    169,0,133,250,169,112,133,25
    1,169,0,1822
95  500 DATA 133,174,133,193,169
    ,12,133,175,133,194,169,198,
    133,252,169,114,2484
D5  510 DATA 133,253,160,0,177,2
    50,145,174,230,250,208,2,230
    ,251,230,174,2867
70  520 DATA 208,2,230,175,165,2
    50,197,252,208,234,165,251,1
    97,253,208,228,3223
88  530 DATA 169,87,133,187,169,
    115,133,188,169,4,133,183,16
    9,0,133,185,2167
C4  540 DATA 160,0,185,49,115,24
    0,6,32,210,255,200,208,245,3
    2,207,255,2399
30  550 DATA 240,251,201,48,240,
    4,201,56,48,230,41,15,133,18
    6,76,234,2205
84  560 DATA 245,147,17,17,73,78
    ,80,85,84,32,68,69,86,73,67,
    69,1280
58  570 DATA 32,78,85,77,66,69,9
    2,13,17,67,65,83,61,49,32,47
    ,923
75  580 DATA 32,68,73,83,75,61,3
    2,56,32,79,82,32,57,58,45,32
    ,897
FF  590 DATA 0,66,79,82,68,0,0,0
    ,0,0,0,0,0,0,0,0,295
AA  600 DATA 0,255,255,255,255,0
    ,0,0,0,0,0,0,0,0,0,1020
```

PROGRAM: BORD DEMO

```
1000 POKE167,0
1010 BLOAD"BORD",B0,P3072
1020 POKE250,1
1030 FORX=1TO25:D$=D$+"■":NEXT
1040 GOSUB 2160
1050 SLEEP2
1060 FORX=1TO100
1070 READTX$
1080 IFTX$="W"THENGOSUB1250:NEXT
1090 IFTX$="R"THENGOSUB1300:NEXT
1100 IFTX$="R+"THENGOSUB1340:NEX
T
1110 IFTX$="D"THENGOSUB1380
1120 FORY=1TOLEN(TX$)
1130 IFLEN(TX$)<=1THENSLEEP1
1140 PRINTMID$(TX$,Y,1);
1150 FORDE=1TO20:NEXT
1160 NEXT
1170 PRINT
1180 NEXT
1190 SLEEP3
1200 DO UNTIL(PEEK(167))=0
1210 SYS3078
1220 SLEEP2
1230 LOOP
1240 END
1250 READ TX,TY,BX,BY,C,TX$
1260 SYS3075
1270 WINDOW TX,TY,BX,BY,C
1280 SYS3072
1290 RETURN
1300 SYS3078
1310 SLEEP2
1320 PRINT"■"
1330 RETURN
1340 SYS3078
1350 SLEEP2
1360 PRINT"■";LEFT$(D$,PEEK(228)
)
1370 RETURN
1380 DIRECTORY"BORD*"
1390 TX$=""
1400 SLEEP2
1410 RETURN
1420 DATA"W",4,14,35,22,1,,
1430 DATA" THIS PROGRAM DEMONSTR
ATES"
1440 DATA" THE MULTI WINDOW UTIL
ITY"
1450 DATA" WHICH CAN BE LOADED I
NTO"
1460 DATA" YOUR PROGRAMS BY USIN
G THE"
1470 DATA" BLOAD COMMAND"
1480 DATA" E.G. -BLOAD'BORD',B0,
P3072-",
1490 DATA" THE CODE CONTAINS 3 R
OUTINES"
1500 DATA" GIVING:-"
1510 DATA"   WINDOW BORDER  - SY
S3072"
1520 DATA"   SCREEN STORE   - SY
S3075"
1530 DATA"   SCREEN RESTORE - SY
S3078",
1540 DATA" WINDOW BORDER SHOULD
BE CALLED"
1550 DATA" DIRECTLY AFTER THE WI
NDOW CMD"
1560 DATA" AND DRAWS A BORDER AL
L AROUND"
1570 DATA" THE WINDOW JUST CREAT
ED",
1580 DATA" SCREEN STORE SHOULD B
E CALLED"
1590 DATA" PRIOR TO THE WINDOW C
OMMAND"
1600 DATA" AND 'SAVES' THE WHOLE
 SCREEN"
1610 DATA" TO PART OF THE 16K RA
M USED"
1620 DATA" BY THE SYSTEM FOR THE
 80 COL"
1630 DATA" SCREEN MODE - ALLOWIN
G 16"
1640 DATA" SCREENS TO BE 'STORED
'",
1650 DATA" & SCREEN RESTORE WILL
 RESTORE"
1660 DATA" THE LAST SCREEN SAVED
"
1670 DATA"W",4,2,19,8,1,,,
1680 DATA"■ THERE ARE MANY"
1690 DATA" USES FOR THIS"
1700 DATA" UTILITY",
1710 DATA" ONE BEING"
1720 DATA" MULTIPLE"
1730 DATA" PULL DOWN"
1740 DATA" MENUS   E.G.-"
1750 DATA"W",22,2,28,10,1,
1760 DATA"■SCRATCHDIRECT LOAD
SAVE   FORMAT PATCH  QUIT■"
1770 DATA"W",22,2,28,10,0,
1780 DATA"■DIRECT■■",
1790 DATA"W",9,5,36,14,1,,"D"
1800 DATA"R","R"
1810 DATA"■■■■■QUIT■■",,"R+"
1820 DATA" AS YOU CAN SEE"
1830 DATA" THE SCREEN IS"
1840 DATA" RESTORED TO"
1850 DATA" IMMEDIATELY"
1860 DATA" BEFORE THE LAST"
1870 DATA" SYS3075 CALL",
1880 DATA" APPLICATIONS"
1890 DATA" ARE JUST AS"
1900 DATA" FATHOMLESS"
1910 DATA" AS THE MIND",
1920 DATA"W",5,5,23,20,1,
1930 DATA" THEY CAN BE USED:-",
1940 DATA"----OVERLAPPING----",
1950 DATA"W",8,8,20,17,1,
1960 DATA"    NESTED"
1970 DATA"W",10,10,18,15,1,,
1980 DATA"W",9,6,34,9,1,
1990 DATA"------------LONG-------
----",
2000 DATA"W",15,2,15,22,1,
2010 DATA"..... THIN .....",
2020 DATA"W",5,4,34,18,1,
2030 DATA" IN FACT YOU WILL PROB
ABLY"
2040 DATA" NEVER USE 16 OVERLAPP
ING"
2050 DATA" WINDOWS IN ANY APPLIC
ATION"
2060 DATA" BUT..",
2070 DATA" ONLY YOUR IMAGINATION
"
2080 DATA" WILL LIMIT THEIR USE"
,
2090 DATA" THEREFORE I'LL FINISH
 BY"
2100 DATA" RESTORING EACH SCREEN
"
2110 DATA" UNTIL THE ORIGINAL SC
REEN"
2120 DATA" IS DISPLAYED",,
2130 DATA" GOOD-BYE",
2140 DATA" AND THANKS FOR WATCHI
NG",,,
2150 END
2160 FOR X=1024 TO 2023
2170 POKEX,INT(RND(1)*100+1)
2180 NEXT X
2190 RETURN
```

LIFESAVERS 12	C64	DATA ERRORS	1/2

When typing in a large amount of data, such as most *Your Commodore* listings, it is quite likely that you will make at least one typing mistake.

When you eventually RUN the program it can be especially annoying to be presented with an ILLEGAL QUANTITY ERROR IN LINE message. Even more annoying is the fact that upon checking the line in the error message you can't see anything wrong with it.

Imagine the following situation:

You have typed in the listing below, enter it now if you like:

```
10 A=A+1 : READ X  :  IF  X  = -1
THEN SYS 49152
20 POKE 49152+A,X : GOTO 10
30 DATA 169,0,132,16,5
40 DATA 255,255,255,257,255
50 DATA 169,0,132,16,5
60 DATA -1
```

Line 10 READs the numbers from the DATA statements. Line 20 POKEs the numbers that you have read into memory.

When you RUN the above program all will be well until the program reaches the 257 in line 40. Line 10 READs this number without any problems. However, as soon as line 20 attempts to POKE it into memory you will get the dreaded ILLEGAL QUANTITY ERROR IN LINE 20 message. Nothing is wrong with line 20, it's the DATA that is at fault since you can only POKE numbers up to 255 into a memory location. The number that was being POKEd in the above example was 257, hence the error.

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BREAK

Bug Finder

We'd like to remind our readers that we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.

A description of your problem.

If possible a listing of your work (you may omit this).

A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

Note: we can only deal with problems relating to programs published in *Your Commodore*.

At the *Your Commodore* office we receive hundreds of letters from readers every month. We do try and answer each individually but sometimes this is impossible due to pressure of work. If you have written to us and not received a personal reply, we apologise for this but we cannot promise to reply to every item of mail we receive. If you feel that your question or letter really needs an answer, then inclusion of an s.a.e. will guarantee a reply, although this may still take time to arrive.

Oops!

Unfortunately the gremlines found their way into the SIMPLE program that we published in the August 1988 issue of the magazine. You will find the corrections below together with more detailed instructions on how to enter the program.

These are the only corrections that the program requires, if you still have problems we suggest that your typing very carefully.

Entry Instructions

1) Type in and save the program.
2) Enter the following:

```
POKE 10240,0: POKE 44,40 NEW
```

3) Load the SIMPLE basic loader.
4) Type: RUN
5) When finished type: NEW
6) Enter the listing presented here.

```
PROGRAM: SIMPLE CORRECTION

FD   10 PRINTCHR$(27)"RPOKING COR
     RECTION DATA...[DOWN]"
CS   20 FORL=100TO120STEP10:READS
     ,E,C
6A   30 FORA=STOE:READD$:D=DEC(D$
     ):C=C-D:POKEA,D:NEXTA
0B   40 IFC<>0THENPRINT"ERROR FOU
     ND IN LINE"L:END
B6   50 NEXTL:PRINT"DATA ALL CORR
     ECT":END
BF   55 DATA5184,5203,2379,48,A9,
     00,8D,12,FF,A9,20,8D,13,FF,A
     9,88,8D,07,FF,68,4C,0E,CE
13   60 DATA6485,6497,1055,78,A9,
     40,8D,14,03,A9,14,8D,15,03,5
     8,60
25   65 DATA6498,6510,11921,78,A9
     ,0E,8D,14,03,A9,CE,8D,15,03,
     58,60
```

7) Type: RUN
8) Type: MONITOR
9) Enter the following to save the program:

```
S "SIMPLE",8,1000,2801 for disk or:
S "SIMPLE",8,1000,2801 for tape.
```

Software Submissions.

Readers who have sent, or who are thinking of sending, programs for possible publication will be pleased to know that we are now up to date with all such items.

We would like to thank all contributors for their patience in waiting for a reply from us.

A new computerised system has been set up to deal with readers submissions which should enable us to deal with them much quicker.

Should you have any queries about submissions please write to:

Program Submissions Query
Your Commodore
1 Golden Square
London W1R 3AB.

Puzzle Corner

Puzzle A

Consider the word *ABCESS*. You will see that it contains three consecutive letters viz *ABC*.

There are 26 such triplets. Obviously many of them do not appear in any recognisable English word. How many words can you find that have three consecutive letters? Remember, they don't have to be at the start of the word.

Puzzle B

As a change from triangles, how many rectangles are there in **Diagram A**.

Send your entries to, November Puzzle Corner, *Your Commodore* 1 Golden Square, London W1R 3AB

The first two correct answers pulled out of the hat on the closing date of November 30th will receive a free *Your Commodore* binder.

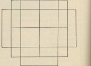

Diagram A

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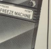

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Volume 5 Number 2

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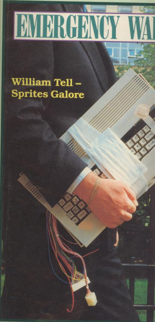

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